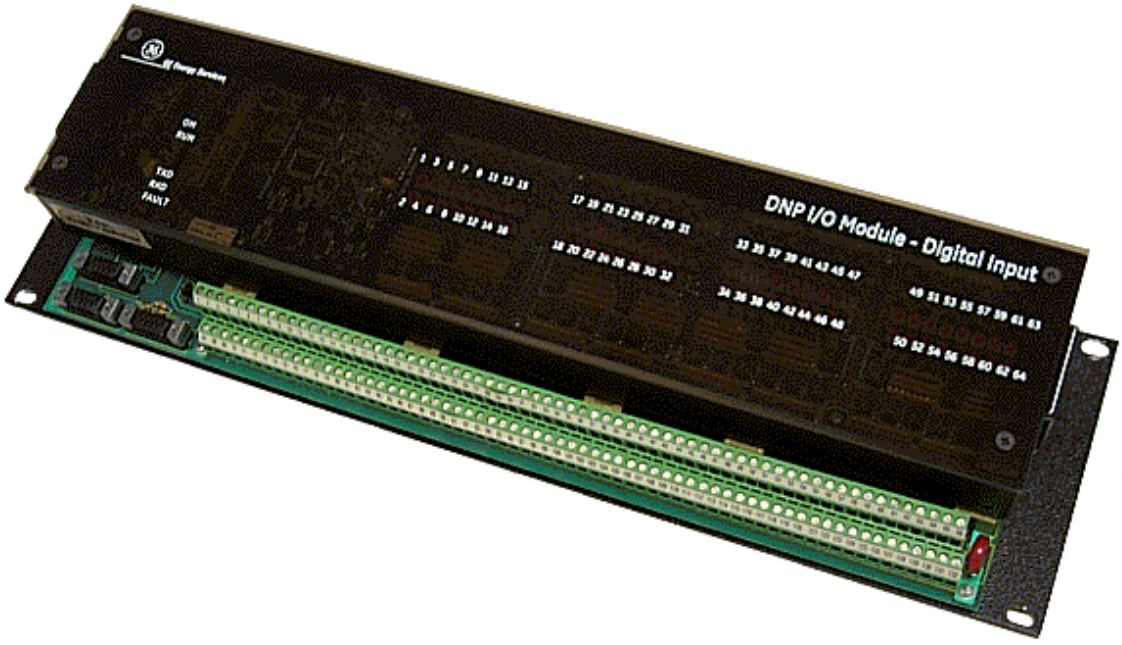
GE
Digital Energy

DNP I/O Modules

Installation and Maintenance Guide

994-0085
Version 2.00 Revision 5



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GE Information

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Important

DNP I/O Module circuit boards contain electrostatically sensitive electronic components. To prevent damage when handling these products, use approved static control procedures.

Contents

Sections

The *DNP I/O Module Installation and Maintenance Guide* is divided into two sections. *Section 1: Installation and Commissioning* shows you how to install, configure, cable, power up and test your DNP I/O Module. *Section 2: Operation and Maintenance* shows you how to operate and maintain your DNP I/O Module, and how to troubleshoot and resolve problems if they occur.

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About This Document

Purpose

The purpose of this document is to provide users with information on how to install and maintain DNP I/O modules.

Intended Audience

This document is intended for readers who are installing or maintaining a GE DNP I/O module. Readers are assumed to have background knowledge of substation automation equipment and practices.

Additional Documents

For further information, refer to the following documents:

- *ConfigPro* Online Help*
- *D25 Installation and Operation Guide* (994-0076)
- *DNP V3.00 DCA - Configuration Guide* (B023-0CG)
- *iBOX Installation and Maintenance Guide* (994-0047)
- *D400* Substation Data Manager User's Manual* (994-0089)
- *PROMAINT User's Guide* (P010-0UG)

Connection Labels

Refer to the following Module Layout Drawings:

- *DNP Combinations I/O (504-0302-ML; HV 504-0303-ML)*
- *WESDAC D20 (C+ 504-0002-ML; CHV 504-0003-ML)*
- *WESTERM D20 (C 517-0169-ML; C4Z 517-0239-ML)*
- *DNP I/O Module-Digital Input (507-0301-ML; HV 507-0303-ML)*
- *WESDAC D20 (S 507-0101-ML; SHV2 507-0103-ML)*
- *WESTERM D20 (S 517-0165-ML; SZ 517-0241-ML)*
- *DNP I/O Module-Control Output (508-0301-ML; HV 508-0302-ML)*
- *WESDAC D20 (K 508-0101-ML; HV 508-0102-ML)*
- *WESTERM D20 (K 517-0164-ML; K4Z 517-0242-ML)*
- *DNP I/O Module-DC Analog Input(511-0301-ML; HV 511-0303-ML)*
- *WESDAC D20 (A 511-0101-ML; AHV2 511-0103-ML)*
- *WESTERM D20 (A 517-0163-ML; AZ 517-0240-ML)*

Product Support

If you need help with any aspect of your GE Digital Energy product, you have a few options.

Search Technical Support

The GE Digital Energy Web site provides fast access to technical information, such as manuals, release notes and knowledge base topics. Visit us on the Web at:

http://www.gedigitalenergy.com/

Contact Customer Service

The GE Energy Customer Service Center is open 24 hours a day, seven days a week for you to talk directly to a GE representative.

In the U.S. and Canada, call toll-free: 1 800 547 8629

International customers, please call: +1 905 927 7070

Or e-mail to multilin.tech@ge.com

Section 1: Installation and Commissioning

Product Returns and Safety

Product returns

Before you return a product, please contact the GE Digital Energy Customer Service Center to obtain a Return Merchandise Authorization number and complete instructions for return shipments.

A Return Merchandise Authorization (RMA) number must accompany all equipment being returned for repair, servicing, or for any other reason.

Note: Product returns will **not** be accepted without a Return Merchandise Authorization number.

Trying to resolve problems using methods that are not recommended by GE Energy may result in damage or injury to persons and property.

Safety Precautions

Follow all safety precautions and instructions in this guide, as follows:

- Only qualified personnel should work on DNP I/O Modules. Maintenance personnel should be familiar with hazards associated with electrical equipment.
- All AC voltage and current terminals are protected from accidental contact by mechanical safety shields. DNP I/O Modules have been designed so that, in most cases, field wiring does not have to be disconnected when you are replacing field-replaceable assemblies.
- Many of the components within the DNP I/O Modules are susceptible to damage from electrostatic discharge. Observe standard ESD (Electrostatic Discharge) precautions.

Product Returns and Safety, Continued

Hazardous Voltages

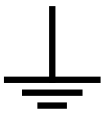
Since hazardous voltages can cause shock, burns or death:

- Due to the common bus architecture of the DNP I/O Modules, an energized condition may exist due to induced voltage or unrelated voltage backfeed even though specific parts of the circuit have been de-energized and may be presumed to be safe. Qualified personnel should confirm the circuit has been de-energized before commissioning or servicing the unit.
- Disconnect and lock out all power sources before servicing and removing components.
- Short all current transformer primaries before servicing.
- DNP I/O Modules are designed to allow the WESDAC logic assembly to be hot-swapped. This assembly can be safely replaced without powering down the unit.
- Connectors under plastic covers carry hazardous voltages. Removal of these plastic covers will expose hazardous voltages.

Warning Symbols

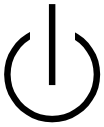
Caution (refer to accompanying documentation)

Caution (risk of electric shock)



Earth/Ground Terminal

Protective Ground Terminal



Power Supply Off (Stand-by Mode)

Power Supply On

Direct Current

Alternating Current

Product Returns and Safety, Continued

Operating Environment

DNP I/O Modules are intended for indoor use. Do not place these products in environments where unusual conditions exist (windblown dust and dirt, liquids, etc.) unless you install them in a secondary protective enclosure.

For proper fire protection, DNP I/O Modules must be installed in an enclosure that includes a metal floor with no openings.

Protection during Maintenance

Ensure that the DNP I/O Module is protected from falling debris during maintenance.

Small metallic particles (such as wire clippings) could fall onto circuit boards and damage or interfere with the safe and reliable operation of the DNP I/O Module.

If you cover the unit for maintenance, remove the cover before operating, so that adequate cooling airflow is maintained.

Operation in Residential Areas

DNP I/O Modules generate radio frequency energy. If they are not operated and used in accordance with the instructions provided in this guide, they may cause harmful interference to radio communications in a residential area. Users are required to correct interference at their own expense.

Rack Spacing for free airflow

When mounting multiple DNP I/O Modules in a rack (or if you are mounting a DNP I/O Module in a rack with other equipment) verify that there is at least one rack unit (RU) space above and below the DNP I/O Module to allow for cooling airflow, and for routing cables between customer equipment and the DNP I/O Module (1 RU = 1.75 inches).

PROMAINT Cable

Use only a standard PROMAINT cable (GE Energy part number 977-0300) when you are connecting to the DNP I/O Module's front panel PROMAINT connector (labeled J3). Use of any other cable may cause serious damage.

Product Returns and Safety, Continued

Do's and Don'ts

Follow these practices at all times:

1. Surge and noise suppression components used on the DNP I/O Module are designed to conduct during transients to prevent nuisance operation or damage to internal components. To ensure shunting of transients from line to ground, the DNP I/O Module's earth ground point must be connected to a low impedance ground using braided cable or a solid copper conductor (a 12 AWG wire is recommended). When making ground connections, ensure that all surfaces that are used for grounding are free of dirt, residue and corrosion. An insulating coating, such as those available from Glyptal or their distributors, can be used to protect these connections from oxidation and dirt deposits.
2. Ensure that cable shields are grounded at either the DNP I/O Module ground point or at the field equipment. Do not ground the shields at more than one point because a potential difference may exist between grounds, causing ground loops and undesirable noise sources.
3. Always replace fuses with the same type and rating as those originally provided by GE Energy.
4. To prevent interference with communications, route all communication cables away from power carrying cables.
5. Always fuse-protect field power sources.
6. Always configure the jumpers in your DNP I/O Module prior to connecting field I/O.
7. Follow all instructions in this guide as they are presented.
8. Do not operate the DNP I/O Module if it has been dropped or damaged. Return it to GE Energy for inspection and repair.
9. Input voltages must be within specified limits (see "Appendix A: Product Specifications" on page 39) prior to connecting power sources to the DNP I/O Module. Do not apply voltages outside the range of the product specifications. Voltages outside the specified range may lead to product failure.
10. Do not modify the DNP I/O Module without prior written authorization from GE Energy.

Protective Earth/Ground

Make sure that the DNP I/O Module is connected to a site ground, using the designated connection point on the WESTERM board.

Connection must be provided with a separate wire connected between the DNP I/O Module and the protective earth system of the facility.

Familiarization

What is the DNP I/O Module?

DNP I/O Modules provide input/output support, based on the Distributed Network Protocol (DNP), for the following GE Energy RTUs (Remote Terminal Units):

- D25 IED
- D400 Substation Data Manager
- iBOX

DNP I/O Modules are factory pre-configured, based on customer requirements. In most cases, you will only need to configure the module's DNP address and baud rate.

There are four types of DNP I/O Modules:

DNP I/O Module	Description
DC Analog Input	32 DC analog inputs
Digital Input	64 digital inputs
Control Output	32 control outputs
Combination I/O	8 control outputs 16 digital inputs Optional 16 DC analog inputs or 8 DC analog inputs and 8 DC analog outputs

DNP DC Analog Input Module

The DNP DC Analog Input Module provides termination for 32 DC analog inputs (+, -, and shield), and sockets for analog scaling networks. Analog loop current can be supplied by the DC Analog Input Module's power source, or from an external source.

Note: Your will need to configure your DNP DC Analog Input Module for 50 Hz or 60 Hz operation. Refer to the ML drawing that shipped with the unit for instructions.

DNP Digital Input Module

The DNP Digital Input Module has 64 digital inputs, which can be optioned as one of the following:

- 64 single status inputs,
- 32 double status inputs,
- 64 single counter inputs, or
- 32 double counter inputs.

Contact wetting can be supplied from the Digital Input Module's power source, or from an external source.

Familiarization, continued

DNP Control Output Module

The DNP Control Output Module provides 32 control outputs, which can be optioned as one of the following:

- 32 trip/close pairs,
- 32 individual controls, or
- 16 raise/lower pairs.

The DNP Control Output Module has a Local/Remote switch. If you set the Local/Remote switch on the DNP Control Output Module to "Local", you will not be able to exercise supervisory control of substation equipment from the RTU. If you set the switch to "Remote", you will be able to execute supervisory control through the RTU.

Control output power can be supplied from the Control Output Module's power source, or from an external source.

Interposing Relays

If the load rating of the controlled devices exceeds the DNP Control Output Module or Combination Input Output Module relay rating (refer to "DNP Control Output Module Specifications" on page 41), you will need to install an Interposing Relay panel. Contact GE Energy for ordering information.

Familiarization, continued

DNP Combination Input Output Module

The DNP Combination Input Output Module has 16 digital inputs, which can be optioned as one of the following:

- 16 single status inputs,
- 8 double status inputs,
- 16 single counter inputs, or
- 8 double counter inputs.

Contact wetting can be supplied from the Combination Input Output Module's power source, or from an external source.

The DNP Combination Input Output Module provides 32 control outputs, which can be optioned as one of the following:

- 8 trip/close pairs,
- 8 individual controls, or
- 4 raise/lower pairs.

The DNP Control Output Module has a Local/Remote switch. If you set the Local/Remote switch on the DNP Control Output Module to "Local", you will not be able to exercise supervisory control of substation equipment from the RTU. If you set the switch to "Remote", you will be able to execute supervisory control through the RTU.

Control output power can be supplied from the Control Output Module's power source, or from an external source.

The DNP C Combination Input Output Module provides termination for 16 DC analog inputs (+, -, and shield), and sockets for analog scaling networks. Or 8 DC analog inputs and 8 DC analog outputs. Analog loop current can be supplied by the Combination Input Output Module's power source, or from an external source.

Note: You will need to configure your DNP DC Analog Input Module for 50 Hz or 60 Hz operation. Refer to the ML drawing that shipped with the unit for instructions.

Note: The default factory jumper settings are set for trip/close. Please refer to the module layout drawing to adjust for different operation.

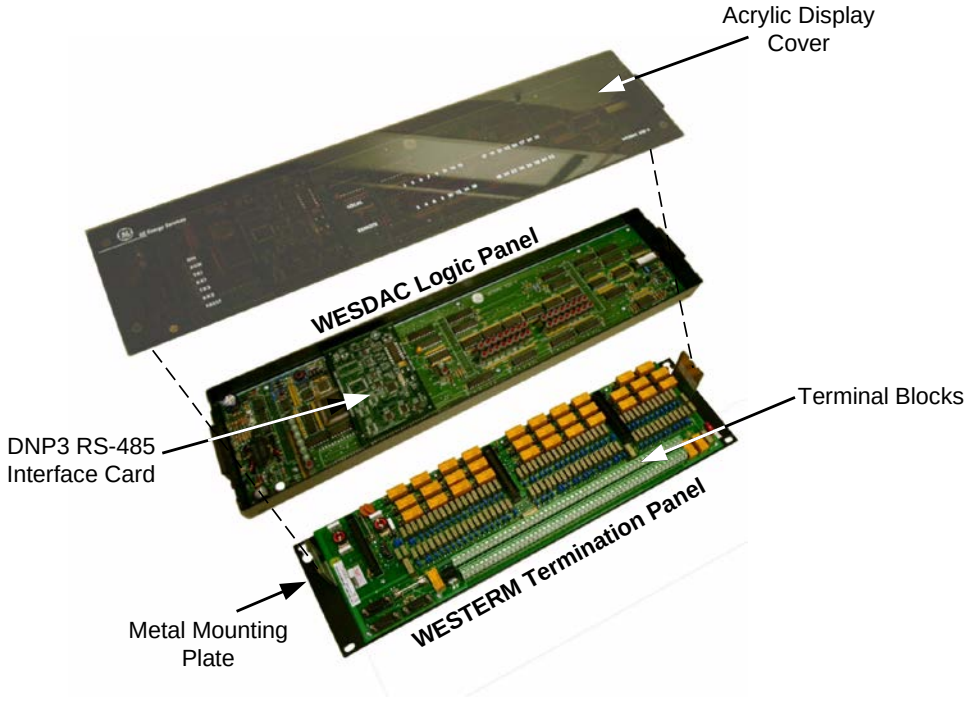
Familiarization, continued

I/O Module Assembly

DNP I/O Modules consist of two panels:

- WESDAC logic panel
- WESTERM termination panel

The WESDAC logic panel contains the DNP I/O Module's logic circuitry and active components. It is equipped with a DNP3 RS-485 interface card, as shown below. The WESTERM termination panel provides termination for field I/O, power, maintenance access (PROMAINT port), and DNP3 Links.



The WESDAC logic panel plugs directly onto the WESTERM termination panel. The WESTERM termination panel sits on a 5.25" wide metal mounting plate designed for rack or horizontal mounting. The WESDAC logic panel enclosure has a semi-transparent acrylic faceplate, through which the user can monitor the LED indicators associated with DNP I/O Module and field I/O status.

Hot-swap DNP I/O Module assemblies

The WESDAC logic panel can be hot-swapped off the WESTERM termination panel without disconnecting power, ground, field wiring, or DNP3 Link cabling.

Module failures are indicated by the LED displays. If a unit fails, you can unplug the failed WESDAC logic panel and replace it with a working unit without removing power to the unit.

Familiarization, continued

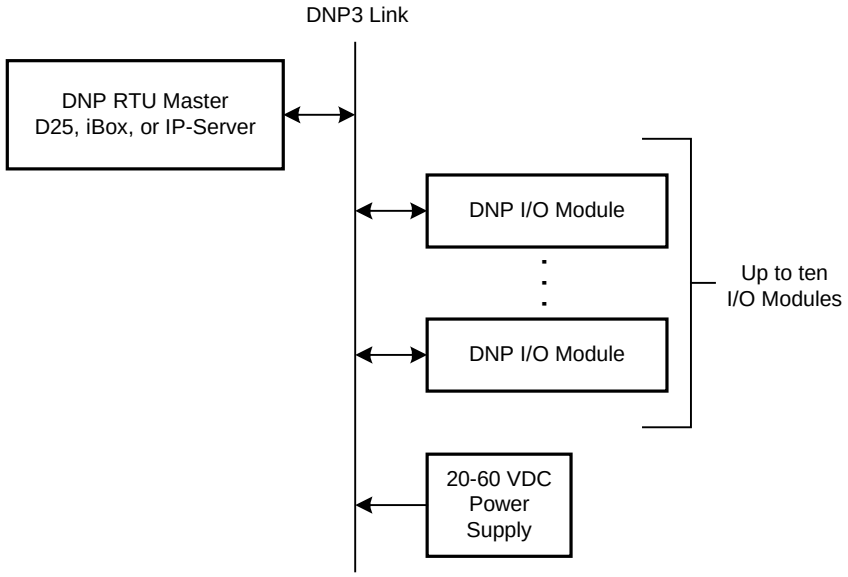
Termination Types

Each DNP I/O Module can be ordered with one of four types of field termination:

Compression	Field wiring is terminated directly onto board-mounted screw-compression terminal blocks on the DNP I/O Module.
DB25	Field wiring is terminated onto DB25 female connectors on the DNP I/O Module.
Disconnect	Field wiring is terminated onto plug-on terminal blocks, which then mate with board-mounted headers on the DNP I/O Module.
Barrier	Field wiring is terminated onto barrier strips on the DNP I/O Module.

DNP3 Link

DNP I/O Modules are multi-dropped from the DNP RTU Master, as illustrated below:



Communications between the DNP RTU Master and the DNP I/O Modules takes place over the DNP3 Link. The DNP3 Link is based on:

- RS-485, at programmable bit rates of 9600, 19200 or 38400 baud, and
- DNP3 Level 2 protocol.

Familiarization, continued

Power Supply

The 20-60 VDC power supply must be capable of delivering power to all of the DNP I/O Modules. Power requirements for each DNP I/O Module can be found in "Appendix A: Product Specifications" on page 39.

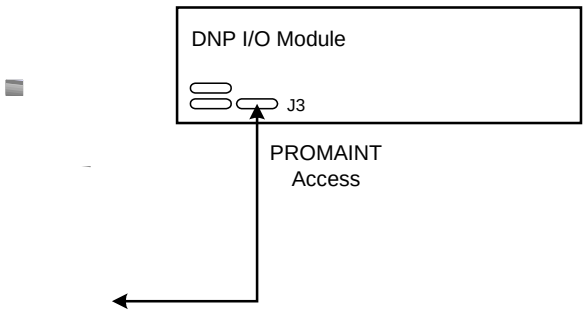
Note: Refer to "Procedure: DNP3 Link Cabling" on page 26 for a more detailed description of the cabling between the DNP RTU Master, DNP I/O Modules and Power Supply.

Number of DNP I/O Modules

The number of DNP I/O Modules that can be supported on the DNP3 Link depends on performance requirements and RS485 baud rate and communication loading. As the number of DNP I/O Modules increases on a multi-drop communication link, the latency in receiving events from any DNP I/O Modules will be extended, due to the longer communications cycle time.

PROMAINT

PROMAINT is an embedded maintenance utility that is used to monitor, calibrate and troubleshoot DNP I/O Modules. PROMAINT is accessed through J3, the DB9 maintenance port, as illustrated below:



Note: Use only a standard PROMAINT cable (GE Energy part number 977-0300) when you are connecting to the DNP I/O Module's PROMAINT connector (labeled J3). Use of any other cable may damage the unit.

For instructions on how to use PROMAINT, refer to the *PROMAINT User's Guide (P010-0UG)*.

Getting Started

Installation Tools, Equipment and Accessories

Before you begin to install your DNP I/O Module, gather the required tools, equipment and accessories:

- Flathead screwdriver with 0.6 x 3.5 mm blade (for terminal block wiring)
- #2 Phillips screwdriver (for rack mounting the unit)
- Wire cutters (for field wiring)
- Wire strippers (for field wiring)
- Wire crimping tool (for field wiring)
- Tie-wraps (for organizing wiring and cables)
- Multimeter (for testing I/O points)
- Needle nose pliers (for setting jumpers, for example)

Depending on how you are going to be labeling your cables and wires, you may need:

- Heat-shrink label printer
- Heat gun (for shrinking)

Getting Started, continued

Installation Steps

Follow these steps, which are outlined in more detail in subsequent sections, to configure, install and commission your DNP I/O Module.

Step	Action
1	Unpack the DNP I/O Module.
2	Inspect the DNP I/O Module for damage. Note: Report any damage immediately to GE Energy. See "Product Returns and Safety" for contact details.
3	Configure the jumper settings on your DNP I/O Module for board address, baud rate, and I/O configuration. Note: For instructions on how to configure your Module's I/O, refer to the ML (Module Layout) drawing.
4	Configure your DNP RTU Master. Refer to "Configuring your RTU Master" on page 20.
5	Mount the DNP I/O Module in the rack or cabinet.
6	Cable the DNP I/O Module, as set out in "Connection": • Ground wire • DNP3 Link cabling • External power (if required for the application)
7	Power up the DNP I/O Module and check for normal operation. See "Power-up and Test" on page 29.
8	Connect and verify your field I/O wiring.

Configuration

Overview

You need to:

- Configure your DNP I/O Module inputs and outputs using the ML drawing that shipped with the unit.
- Configure your DNP I/O Module device address and DNP3 port baud rate using the jumper settings.
- Configure your RTU Master to operate with your DNP I/O Module.

Procedure: Configuring your DNP I/O Module

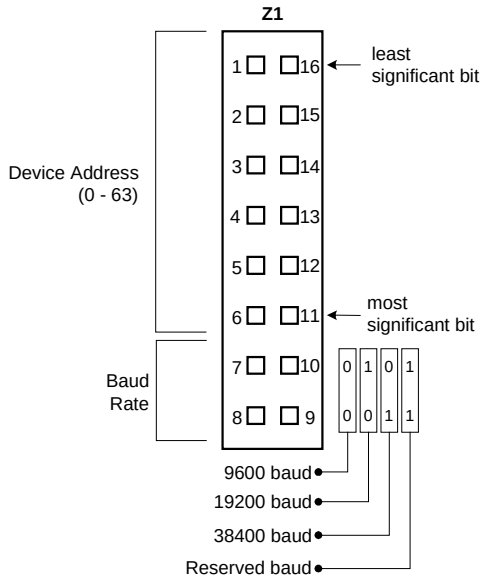
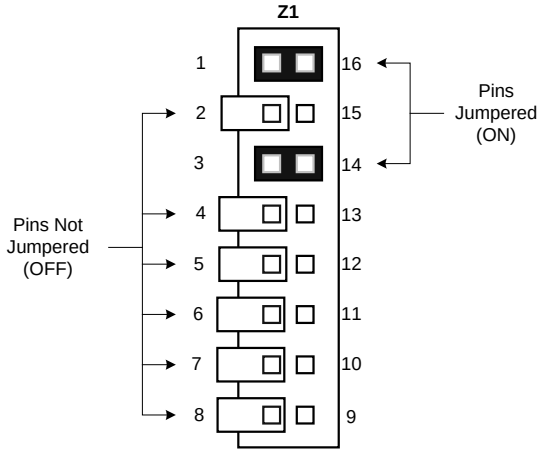
Before installation, configure the jumper settings on your DNP I/O Module. You may need to configure the Module's device address and baud rate, as follows:

Step	Action
1	Remove the WESDAC logic panel to expose the WESTERM board. Tip: To remove the WESDAC module from the WESTERM module, ease the WESDAC module alternately on one side, then the other, until it disengages from the WESTERM termination panel. Once the unit is installed on the rack, you will be able to pull the WESDAC logic panel straight off the WESTERM termination panel.
2	On the WESTERM board, locate jumper array Z1. Refer to your Module's ML drawing for the location of this jumper array

Continued on next page

Configuration, continued

Configuring your DNP I/O Module (continued)

Step	Action
3	Set your DNP I/O Module device address and baud rate, by jumpering Z1 as follows: Jumper ON – bit selected (1) Jumper OFF – bit not selected (0)  For example, to select 9600 baud (00), Address 05 (000101), configure Z1 as follows:  Refer to “Appendix D: DNP Address Jumpers” for a tabular summary of Z1 address settings.

Configuration, continued

Configuring your RTU Master

Configuring your iBOX or D25 RTU to work with a DNP I/O Module

Your iBOX or D25 RTU Master communicates with your DNP I/O modules through the DNP3 Data Collection Application (DCA B023). The DNP DCA collects data from, and sends control requests to, the DNP I/O modules.

Use Config Pro to configure the DNP3 DCA in the RTU Master so that it communicates with your DNP I/O module. There are three tables to configure:

- Remote Device Table: This table contains one record for each DNP I/O module in the system. The Remote Device Table specifies the remote devices with which the DCA communicates, the polling parameters for each remote device, and the points configured on each remote device. Each record in the Remote Device Table references the appropriate Remote Device Point Mapping Table(s) and Remote Device Polling Table(s).
- Remote Device Point Mapping Table: Specifies the number and type of data points associated with each DNP I/O module.
- Remote Device Polling Table: Specifies the polling type and frequency for each DNP I/O module.

Instructions and guidelines for configuring your DNP3 DCA can be found in the following documentation:

- *DNP V3.00 DCA - Configuration Guide* (B023-0CG)
- Config Pro online help.

Note: When configuring the Time Sync option:

- Disable Time Sync for the D20A and D20K modules
- If Time Sync is enabled on a D20S module, the polling rate may be a minimum of 2 seconds (it takes about 850ms to do a Time Sync for each device).

Example: Configuring your iBOX or D25 RTU Master to work with a DNP Digital Input Module

Assume we have a DNP Digital Input Module that is factory-configured with 64 digital inputs. The unit's DNP address is 0032, and we want it polled every 500 ms. With every poll, we also want a full status update. To meet these requirements, you would configure the DNP DCA as follows:

Table	Parameter	Value
Remote Device Table	Application Address	0032
Remote Device Point Mapping Table	DCA Object Type	Binary Input
	Number of Device Points	64
Remote Device Polling Table	Poll Data Type	Integrity
	Poll Interval	500 ms

Configuration, continued

Configuring your D400 to work with a DNP I/O Module

The following is a summary of the steps required to configure a D400 to operate with a DNP I/O Module. Refer to the *D400 Substation Data Manager* online help for more detailed information:

Step	Action
1	Browse and log in to the D400.
Creating the Device Type	
2	Click **Configuration** and then click **Client Map**.
3	Click **New** to create a new device map file.
4	On the *New Map File* window, select **DNP** and click **OK**.
5	In the left-hand pane, configure the device point settings.
6	In the right-hand pane, configure the device polling parameters.
7	Click **Save**.
Configuring the DNP3 Serial Port Parameters	
8	Click **Connections**.
9	Click **Add Connection**.
10	On the *New Connection* window, select **Serial Connection** and select **DNP Multidrop** on the *Serial Configuration Type* drop-down list.
11	Configure the connection as required. For *Map File*, select the client map file you created above.
12	Click **Save Configuration**.

Installation

Overview

Once you have configured your DNP I/O Module, you can:

- Physically locate and mount it in a 19” rack or cabinet
- Connect ground, power and link cabling
- Turn power on to the module, and test it to make sure it is functioning properly.

We recommend you complete the above, before you connect and test your field wiring.

Rack Spacing

When mounting multiple DNP I/O Modules in a rack, or when mounting DNP I/O Modules in a rack with other equipment, verify that there is at least one rack unit (RU) of space above and below the DNP I/O Module to allow for cooling air flow and cable routing (1 RU = 1.75 inches or 44.5 mm).

Required Clearances

The exterior dimensions of the DNP I/O Module are:

- 19" wide x 5.25" high x 2.5" deep (483 mm x 133.4 mm x 63.5 mm)

Allow about 14 inches (356 mm) of total cabinet depth, to provide clearance for cables and maintenance access.

Procedure: Mounting on Rack

To mount the DNP I/O Module on a rack:

Step	Action
1	Determine the location of the DNP I/O Module in a 19-inch mounting rack.
2	Install, but don’t tighten the top two mounting screws. Note: Install the DNP I/O Module with the LEDs visible from the front of the rack.
3	Slide the DNP I/O Module over the top mounting screws and drop down into position.
4	Insert the bottom mounting screws.
5	Tighten all four mounting screws.

You are now ready to connect ground, power, and DNP3 link cabling to the DNP I/O Module. See “Connection” on page 24.

Connection

Overview

Use the procedures in this section to:

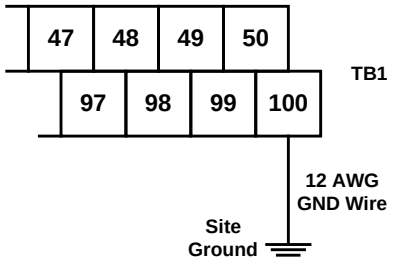
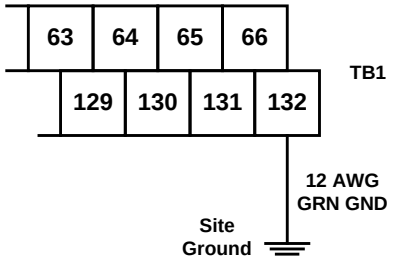
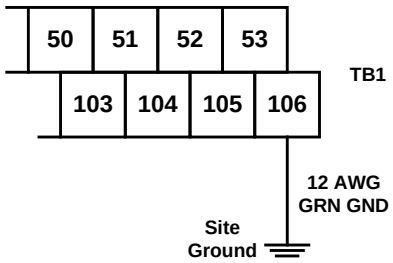
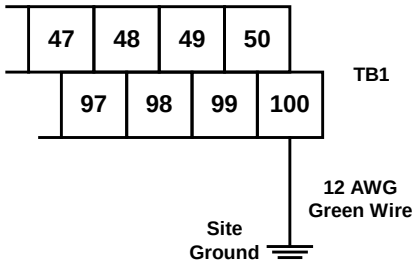
- Connect your DNP I/O Module to site ground.
- Connect an external power supply to your DNP I/O Module, if required for your application.
- Connect your DNP I/O Module to the RTU Master (D25, iBOX or D400).

Protective Earth/Ground

Each type of DNP I/O Module has a different ground point, as shown below.

Procedure: Connecting Protective Ground

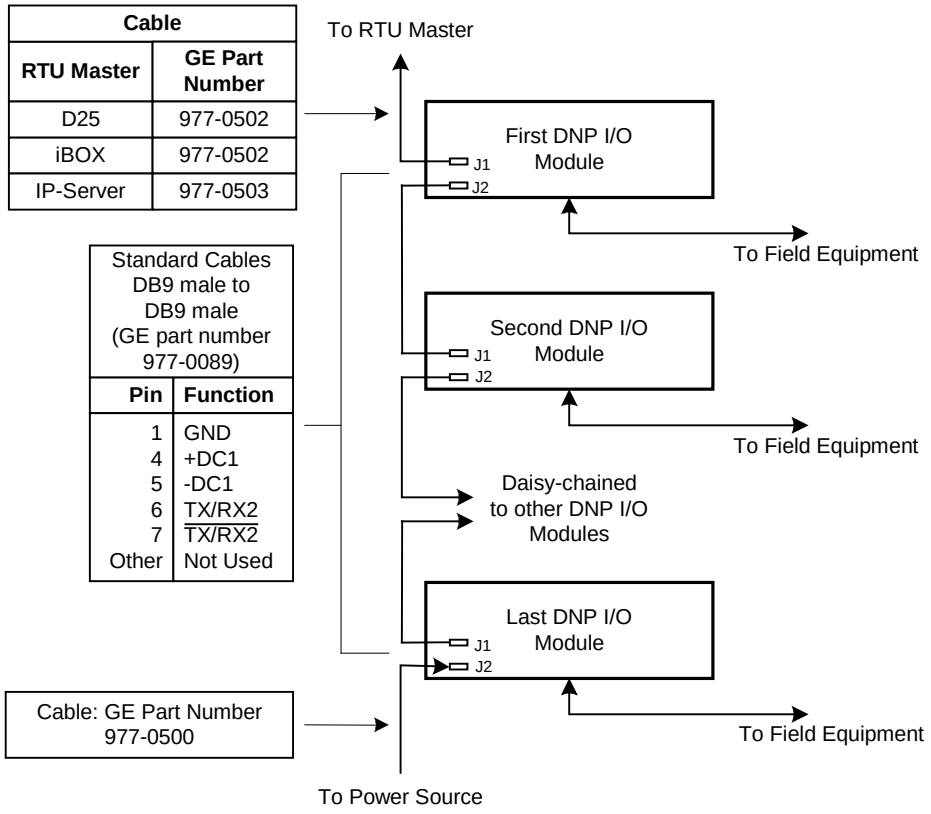
Connect your DNP I/O Module to site ground, using a separate 12 AWG Yellow/Green. The location of protective ground terminal varies between WESTERM I/O module types. Refer to Module Layout drawing of your module for detailed information. For example, see below:

DC Analog Input Module	
Digital Input Module	
Control Output Module	
Combination Input Output Module	

Connection, continued

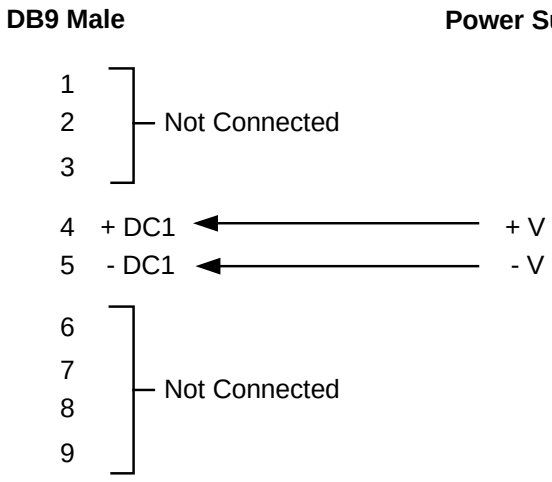
Procedure: DNP3 Link Cabling

Interconnect the DNP3 cabling between each DNP I/O Module, as shown below:



Procedure: Connecting to the Power Source

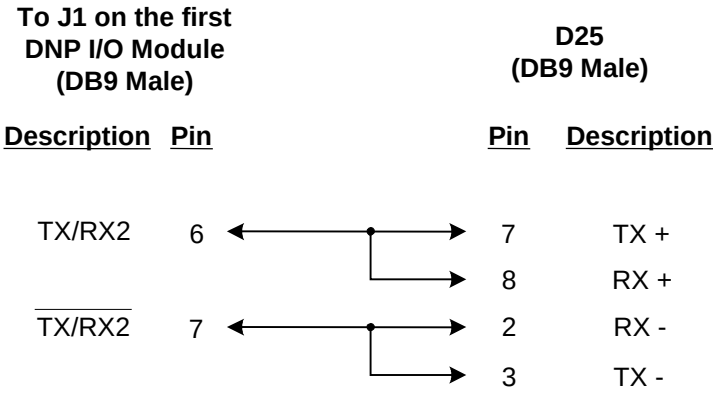
Connect the power supply to the last DNP I/O Module in the chain. The cable from J2 on the last DNP I/O Module to the power source (GE part number 977-0500) has the following connections:



Connection, continued

Procedure: Connecting to a D25

The cable from a D25 RTU Master to the first DNP I/O Module (GE Part Number 977-0502) has the following connections and jumpers:

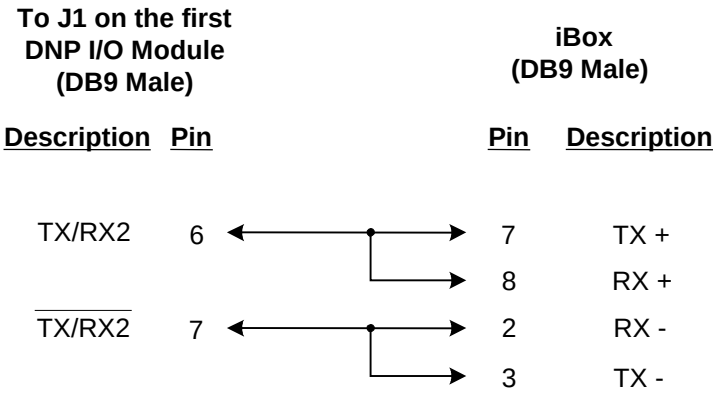


D25 Configuration

Make sure the D25 RTU Master is configured for RS-485, 2W mode.

Procedure: Connecting to an iBOX

The cable from an iBOX RTU Master to the first DNP I/O Module (GE Part Number 977-0502) has the following connections and jumpers:



iBOX Configuration

Make sure the iBOX RTU Master is configured for RS-485, 2W mode.

Connection, continued

Procedure: Connecting to a D400

Refer to section 3.4 *RS-485 Adapter* in the *D400 Substation Data Manager User's Manual* (994-0089) for information on configuring the port for 2-Wire mode.

Refer to section 4.4 *RS-485 Connections* in the *D400 Substation Data Manager User's Manual* (994-0089) for information on typical cable connections.

Field I/O Wiring

We recommend that you test the DNP I/O Module (see "Power-up and Test" on page 29) before connecting your field wiring. If there are any problems with the DNP I/O Module, you can replace it without having to disconnect, then reconnect your field wiring.

Refer to the ML (Module Layout) drawing that was provided with your DNP I/O Module, for instructions on connecting field wiring.

DNP DC Analog Input Module: Loop Supply

The DNP DC Analog Input Module can be configured to provide loop current from the I/O Module's power source (internal), or from an external loop supply. Follow the connection and jumpering instructions outlined on the ML drawing provided with your DNP I/O Module.

DNP Digital Input Module: Status Input Wetting

The DNP Digital Input Module can be configured to provide status input wetting from the I/O Module's power source (internal), or from an external loop supply. Follow the connection and jumpering instructions outlined on the ML drawing provided with your DNP I/O Module.

DNP Control Output Module: External Control Output Supply

The DNP Control Output Module can be configured to provide supply voltages to interposing relay panels from the I/O Module's power source (internal), or from an external loop supply. Follow the connection and jumpering instructions outlined on the ML drawing provided with your DNP I/O Module.

DNP Combination Input Output Module:

The DNP Combination Input Output Module can be configured to provide status input wetting from the I/O Module's power source (internal), or from an external loop supply.

Status Input Wetting and External Control Output Supply

The DNP Combination Input Output Module can be configured to provide supply voltages to interposing relay panels from the I/O Module's power source (internal), or from an external loop supply. Follow the connection and jumpering instructions outlined on the ML drawing provided with your DNP I/O Module.

Power-up and Test

Procedure: Power up and test the DNP I/O Module

Once you have completed your ground, power and DNP Link cabling, the next step is to power up and test your DNP I/O Module:

Step	Action
1	Turn on the RTU Master.
2	Turn on the power source to the DNP I/O Module.
3	Verify that the DNP I/O Module's LEDs indicate normal operation, as follows: **Designation** / **Normal Operation** ON: On solid when power is applied RUN: See "RUN/FAULT Status Indicators" on page 30 TXD: Flashes when data is transmitted by the DNP I/O Module RXD: Flashes when data is received by the DNP I/O Module FAULT: See "RUN/FAULT Status Indicators" on page 30 If the LEDs are not operating normally, see "Troubleshooting" on page 32 for tips to help you diagnose the problem.

Procedure: Testing your Field I/O

Test your DNP I/O Module's inputs or outputs, as appropriate for your RTU Master. Refer to the manual for your RTU Master:

- *D25 Installation and Operation Guide* (994-0076)
- *iBOX Installation and Maintenance Guide* (994-0047)
- *D400 Substation Data Manager User's Manual* (994-0089)

Section 2: Operation and Maintenance

Operation

Status Indicators

All DNP I/O Modules, regardless of type, have the following status indicators:

Designation	Normal Operation
ON	On solid when power is applied
RUN	See "RUN/FAULT Status Indicators" below.
TXD	Flashes when data is transmitted by the DNP I/O Module
RXD	Flashes when data is received by the DNP I/O Module
FAULT	See "RUN/FAULT Status Indicators" below.

Table: RUN/FAULT Status Indicators

Together, the RUN and FAULT LEDs provide additional information about the status of the DNP I/O Module:

RUN LED	FAULT LED	DNP I/O Module Operating Status
Fast Flash	Off	Application operating normally
Slow Flash	Off	Application stopped
Flash (alternating)	Flash (alternating)	Device Configuration Error (board type, address, configuration and code do not match)
Off	Flash	EPROM checksum error
Flash (simultaneously)	Flash (simultaneously)	Device address error

Operation, continued

Module-Specific Status Indicators

DNP I/O modules have the following module-specific status indicators:

DNP I/O Module	Indicator	Description
Digital Input Module	Input point indicator (RED)	The ON/OFF state of the indicated point.
DC Analog Input Module	Analog channel address (RED)	The address of the analog point that is currently being read.
Control Output Module	Local (GREEN)	This indicator will turn on when: • DNP I/O Module is set to Local mode using the Local/Remote switch (see Local/Remote Switch below), or • If the Module's control software has been disabled.
	Remote (RED)	This indicator will turn on when module is in Remote mode, as outlined below.
	Control Points (RED)	These LEDs will turn on when the particular control point is enabled.
Combination Input Output Module	Input point indicator (RED)	The ON/OFF state of the indicated point.
	Analog channel address (RED)	The address of the analog point that is currently being read.
	Local (GREEN)	This indicator will turn on when: • DNP I/O Module is set to Local mode using the Local/Remote switch (see Local/Remote Switch below), or • If the Module's control software has been disabled.
	Remote (RED)	This indicator will turn on when module is in Remote mode, as outlined below.
	Control Points (RED)	These LEDs will turn on when the particular control point is enabled.

Local/Remote Switch

Set the Local/Remote switch on the DNP Control Output Module to "Local" to perform maintenance on the unit. You will <u>not</u> be able to exercise supervisory control of substation equipment from the RTU. Set the switch to "Remote" to restore supervisory control through the RTU.

Troubleshooting

Troubleshooting Tips

The following table provides troubleshooting tips for identifying DNP I/O Module failures:

Symptom	Possible Causes	Resolution
None of the operating LEDs are not lit.	Power is not connected.	Check DNP Link cabling, in particular, cabling downstream (towards the power source).
	Fuse is blown.	Check and replace fuse, if necessary.
FAULT LED is ON solid.	WESDAC board is faulty.	Try replacing the WESDAC board.
FAULT and RUN LEDs are flashing alternately, at a rate of about once per second	WESDAC board is faulty.	Try replacing the WESDAC board.
TXD and RXD LEDs are not flashing	Faulty cabling between the DNP I/O Module and the RTU Master	Check and replace cable, if necessary.

COMMs
Grounding

Both the WESTERM of the DNP peripheral and the master device (e.g., D20, D25, etc.) must be grounded. However, the shield pin must only be connected to the WESTERM of the DNP or the master device in order to prevent circulating currents.

If both the WESTERM of the DNP and the master device are not grounded, the isolated power supplies may have a floating ground, resulting in intermittent communication failures or no communication or resulting in damage to the transceiver IC (if voltage difference is greater than -7V to +12V).

Troubleshooting, continued

PROMAINT

PROMAINT is an embedded, password-protected maintenance utility that is used to monitor, calibrate and troubleshoot DNP I/O modules. Use PROMAINT to:

- Commission and troubleshoot the DNP I/O modules
- Calibrate analog references
- Display the current value of status and analog inputs
- Activate control outputs

To access PROMAINT, connect a PC (running HyperTerminal or similar terminal emulation software) or VT100 terminal to the DNP I/O Module's front panel PROMAINT connector (labeled J3) using a standard PROMAINT cable (GE Energy part number 977-0300). As outlined below, use of any other cable may damage the DNP I/O module.

Configure the terminal emulation software or VT100 terminal as follows:

Bits per second	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	Xon/Xoff

For instructions on how to use PROMAINT, refer to the *PROMAINT User's Guide (P010-0UG).*

PROMAINT Cable

Use only a standard PROMAINT cable (GE Energy part number 977-0300) when you are connecting to the DNP I/O Module's front panel PROMAINT connector (labeled J3). Use of any other cable may cause serious damage.

Replacement

DNP I/O Module Maintenance

DNP I/O Modules do not require scheduled maintenance. However, we recommend periodic inspection to ensure:

- Unit has sustained no accidental physical damage
- Air flow is not obstructed
- Connectors and cables are intact and firmly attached
    - Fuses are intact

Field Replaceable Units

The following components are field replaceable:

- Fuses
- Fully-assembled DNP I/O Module, consisting of a WESTERM Termination Panel and a WESDAC Logic Panel.
- WESDAC Logic Panel
- WESTERM Termination Panel

Fuses

DNP I/O Modules are equipped with following numbers of fuses, all of them located on the WESTERM termination panel:

DNP I/O Module	Fuses
DC Analog Input	2
Control Output	2
Digital Input	3
Combination Input Output Module	5

Changing Fuses

When changing fuses, *always* check the original fuse for value and type, to ensure the replacement fuse is correct.

Replacement, continued

Procedure: Replacing a DNP I/O Module

To replace a DNP I/O Module:

Step	Action
1	Disconnect the DNP Link cables from the DNP I/O Module. Note: Once you disconnect these cables, all units in the daisy chain will be out of service.
2	Disconnect all field wiring from the DNP I/O Module. Tip: Make sure you label these connections carefully, so you can restore them once the replacement unit is installed.
3	Remove external power cabling.
4	Disconnect the ground wire from the DNP I/O Module.
5	Fully unscrew the lower mounting screws. Loosen the upper mounting screws, then raise and remove the DNP I/O Module from the rack.
6	Check the jumpers on the replacement DNP I/O Module and make sure they are the same as those on the failed unit.
7	Mount the replacement DNP I/O Module in the rack. Insert the lower mounting screws, then tighten all mounting screws.
8	Reconnect the ground wire to the DNP I/O Module.
9	Reconnect external power cabling.
10	Reconnect all field wiring, exactly as it was connected previously.
11	Reconnect the DNP Link cables. Note: This will restore power and communications to the DNP I/O Module, and all downstream units.
12	Verify that the replacement DNP I/O Module LED indicators are functioning properly. Refer to “Operation” on page 30 and “Troubleshooting” on page 32.
13	Test your DNP I/O Module’s inputs and outputs, as appropriate for your RTU Master. Refer to the manual for your RTU Master: • *D25 Installation and Operation Guide* (994-0076) • *iBOX Installation and Maintenance Guide* (994-0047) • *D400 Substation Data Manager User’s Manual* (994-0089)
14	Return the failed DNP I/O Module to GE Energy by following the product return procedures.

Replacement, continued

Procedure: Replacing a WESDAC Logic Panel

To replace a WESDAC logic panel:

Step	Action
1	Remove the complete WESDAC logic panel. Tip: To remove the WESDAC module from the WESTERM module, grasp the WESDAC module with both hands and pull it straight out. Tip: You can replace the WESDAC module without powering down the DNP I/O Module. Where DNP I/O Modules have been daisy-chained, you will be able to maintain connection between the RTU Master and the other units in the chain.
2	Check the jumper settings on the replacement WESDAC logic panel and make sure they are they same as the settings on the unit you are replacing.
3	Orient the replacement WESDAC on the metal guides on the DNP I/O Module and push it into place, engaging the connectors on the WESTERM board.
4	Verify that the replacement unit's LED indicators are functioning properly. Refer to "Operation" on page 30 and "Troubleshooting" on page 32.
5	Test your DNP I/O Module's inputs and outputs, as appropriate for your RTU Master. Refer to the manual for your RTU Master: • *D25 Installation and Operation Guide (994-0076* • *iBOX Installation and Maintenance Guide (994-0047)* • *D400 Substation Data Manager User's Manual (994-0089)*
6	Return the failed DNP I/O Module to GE Energy by following the product return procedures.

Replacement, continued

Procedure: Replacing a WESTERM Termination Panel

To replace a WESTERM termination panel:

Step	Action
1	Remove the WESDAC logic panel from the WESTERM termination panel. Tip: To remove the WESDAC module from the WESTERM module grasp the WESDAC module with both hands and pull it straight out.
2	Disconnect the DNP Link cables from the WESTERM termination panel. Note: Once you disconnect these cables, all other units in the daisy chain will be out of service.
3	Disconnect all field wiring from the WESTERM termination panel. Tip: Make sure you label these connections carefully, so you can restore them once the replacement unit is installed.
4	Remove external power cabling.
5	Disconnect the ground wire from the WESTERM termination panel.
6	Fully unscrew the lower mounting screws. Loosen the upper mounting screws, then raise and remove the WESTERM termination panel from the rack.
7	Check the jumper settings on the replacement WESTERM board, and make sure they are the same as the settings on the failed unit.
8	Mount the replacement WESTERM termination panel in the rack. Insert the lower mounting screws, then tighten all four mounting screws.
9	Reconnect the ground wire to the WESTERM termination panel.
10	Reconnect external power cabling.
11	Reconnect all field wiring, exactly as it was connected previously.
12	Reconnect DNP Link cables. Note: This will restore power and communications to the WESTERM termination panel.

Continued on next page

Replacement, continued

Procedure: Replacing a WESTERM Termination Panel (continued)

Step	Action
13	Install the WESDAC logic panel on the replacement WESTERM termination panel.
14	Verify that the LED indicators are functioning properly. Refer to "Operation" on page 30 and "Troubleshooting" on page 32.
15	Test your DNP I/O Module's inputs and outputs, as appropriate for your RTU Master. Refer to the manual for your RTU Master: • *D25 Installation and Operation Guide (994-0076* • *iBOX Installation and Maintenance Guide (994-0047)* • *D400 Substation Data Manager User's Manual (994-0089)*
16	Return the failed WESTERM termination panel to GE Energy by following the product return procedures.

Appendix A: Product Specifications

General Specifications

Temperature	-20 to +70°C
Humidity	0 to 95% non-condensing

DNP Digital Input Module Specifications

Processor	Motorola 68HC11 MPU
Processor Clock Speed	2 MHz
Memory	• 32 K EPROM • 24 K static RAM • 512 bytes EEPROM
Inputs	64 bipolar inputs, organized in eight groups of eight
Point Types	• Status/alarm with COS detection • SOE • Form A or Form C pulse accumulator (32-bit binary counter)
Current Burden	±3 to ±6 mA per input
Scan Rate	1.0 ms
Debounce	Fixed, at 4 ms
SOE Time Resolution	1.0 ms
Contact Wetting	±12, ±24, ±48, ±125 V
Overload Rating	500 VDC (common mode to ground)
Component Isolation Rating	1500 Vrms
Dielectric Rating	1000 VDC
Protocol	Complies with DNP3 Level 2. For specific DNP3 objects supported, refer to "Appendix E: DNP I/O Modules Device Profile".
DNP3 Communication Port	• Mechanical: DB9 female • Electrical: RS-485 • Bit Rate: Jumper-selectable to 9600, 19200, or 38400 baud
Maintenance Port (J3)	• Mechanical: DB9 female • Electrical: RS-232 • Bit Rate: 9600 baud
Power Requirements	20-60 VDC, 3 W typical
Physical Dimensions	19" x 5.25" x 2.5" (compression, DB25 and disconnect term) 19" x 8.75" x 2.5" (barrier term)
Indicators	LED indicator for each point, plus module operating status.

DNP DC Analog Input Module Specifications

Processor	Motorola 68HC11 MPU
Processor Clock Speed	2 MHz
Memory	• 32 K EPROM • 24 K static RAM • 512 bytes EEPROM
Inputs	32 differential inputs (typical): • ±5, ±10 V • ±1, ±2.5, ±5, ±10, ±20 mA
Input Impedance	44 Mohm ±5% (VDC)
Overall Accuracy	±0.05% (voltage), ±0.1% (current)
Temperature Coefficient	±10 ppm per °C
Resolution	14-bit plus sign
Conversion rate (all 32 inputs)	• 550 ms @ 60 Hz • 656 ms @ 50 Hz
Over voltage Rating	±35 VDC
Overload Rating	200 V pp ±5 V input common mode (50/60 Hz)
Common Mode Rejection (60 Hz)	• 95 dB 5 V • 90 dB 10 V
Normal Mode Rejection (60 Hz)	60 dB
Component Isolation Rating	1500 Vrms
Dielectric Rating	1000 VDC
Protocol	Complies with DNP3 Level 2. For specific DNP3 objects supported, refer to "Appendix E: DNP I/O Modules Device Profile".
DNP3 Communication Port	• Mechanical: DB9 female • Electrical: RS-485 • Bit Rate: Jumper-selectable to 9600, 19200, or 38400 baud
Maintenance Port (J3)	• Mechanical: DB9 female • Electrical: RS-232 • Bit Rate: 9600 baud
Power Requirements	20-60 VDC, 7 W typical
Physical Dimensions	19" x 5.25" x 2.5" (compression, DB25 and disconnect term) 19" x 8.75" x 2.5" (barrier term)
Indicators	LED indicator for each point, plus module operating status.

DNP Control Output Module Specifications

Processor	Motorola 68HC11 MPU
Processor Clock Speed	2 MHz
Memory	• 32 K EPROM • 24 K static RAM • 512 bytes EEPROM
Control Outputs	• 32 open drain drivers for relays • 4 additional open drain drivers for dedicated Master Trip/Close and Test Breaker relays
Output Types	• Latching • Trip/Close (T/C) • Raise/Lower (R/L) • Pulse
Non-Matrixed Output Configurations	• 32 T/C pairs • 16 R/L pairs • 32 isolated Form C contact outputs • Optional 32 isolated open drain outputs
Contact Ratings	Momentary relays: 60 W max, 3 A max, 220 VDC max. (1 Form C or A)
Coil Status Check	Every 500 µs
Contact Duration	Programmable 1 to 2^{15} ms in 1 ms intervals, or 1 to 2^{15} s in 1 s intervals (protocol dependent)
Local Control	Remote/Local switch
Dielectric Rating	1000 VDC
Protocol	Complies with DNP3 Level 2. For specific DNP3 objects supported, refer to “Appendix E: DNP I/O Modules Device Profile”.
DNP3 Communication Port	• Mechanical: DB9 female • Electrical: RS-485 • Bit Rate: Jumper-selectable to 9600, 19200, or 38400 baud
Maintenance Port (J3)	• Mechanical: DB9 female • Electrical: RS-232 • Bit Rate: 9600 baud
Power Requirements	20-60 VDC, 4 W typical at 24 V, 11 W max. at 24 V with all relays energized
Indicators	LED indicator for each point, plus module operating status.
Physical Dimensions	19” x 5.25” x 2.5”

DNP Combination Input Output Module Specifications

Processor	Motorola 68HC11 MPU
Processor Clock Speed	3 MHz
Memory	• 32 K EPROM • 24 K static RAM • 512 bytes EEPROM
Digital Inputs/Outputs	16 bipolar inputs, organized in eight groups of eight or 8 bipolar inputs and 8 bipolar outputs
Point Types	• Status/alarm with COS detection • SOE Form A or Form C pulse accumulator (32-bit binary counter)
Current Burden	±3 to ±6 mA per input
Scan Rate	1.0 ms
Debounce	Fixed, at 4 ms
SOE Time Resolution	1.0 ms
Contact Wetting	±12, ±24, ±48, ±125 V
Control Outputs	8 open drain drivers for relays 4 additional open drain drivers for dedicated Master Trip/Close and Test Breaker relays
Output Types	• Latching • Trip/Close (T/C) Raise/Lower (R/L) Pulse
Non-Matrixed Output Configurations	• 8 T/C pairs • 4 R/L pairs • 8 isolated Form C contact outputs Optional 32 isolated open drain outputs
Contact Ratings	Momentary relays: 60 W max, 3 A max, 220 VDC max. (1 Form C or A)
Coil Status Check	Every 500 µs
Contact Duration	Programmable 1 to 2^{15} ms in 1 ms intervals, or 1 to 2^{15} s in 1 s intervals (protocol dependent)
Local Control	Remote/Local switch
Dielectric Rating	1000 VDC
DC Analog Inputs/Outputs	16 differential inputs (typical): • ±5, • ±1, ±2.5, ±5, ±10, ±20 mA or 8 differential inputs (typical): • ±5, • ±1, ±2.5, ±5, ±10, ±20 mA and 8 bi-polar outputs • ±5, ±10 V • ±1, ±5, ±10, ±20 mA
Input Impedance	44 Mohm ±5% (VDC)

Overall Accuracy	±0.05% (voltage), ±0.1% (current)
Temperature Coefficient	±10 ppm per °C
Resolution	14-bit plus sign
Conversion rate (all 32 inputs)	• 550 ms @ 60 Hz • 656 ms @ 50 Hz
Over voltage Rating	±35 VDC
Overload Rating	200 V pp ±5 V input common mode (50/60 Hz)
Common Mode Rejection (60 Hz)	• 95 dB 5 V • 90 dB 10 V
Normal Mode Rejection (60 Hz)	60 dB
Component Isolation Rating	1500 Vrms
Dielectric Rating	1000 VDC
Protocol	Complies with DNP3 Level 2. For specific DNP3 objects supported, refer to "Appendix E: DNP I/O Modules Device Profile".
DNP3 Communication Port	• Mechanical: DB9 female • Electrical: RS-485 • Bit Rate: Jumper-selectable to 9600, 19200, or 38400 baud
Maintenance Port (J3)	• Mechanical: DB9 female • Electrical: RS-232 • Bit Rate: 9600 baud
Power Requirements	20-60 VDC, 7 W typical
Physical Dimensions	19" x 5.25" x 2.5" (compression, DB25 and disconnect term) 19" x 8.75" x 2.5" (barrier term)
Indicators	LED indicator for each point, plus module operating status.

Appendix B: DNP Point Mapping

This appendix presents the logical mapping between DNP points, as they are defined in the DNP3 Data Collection Application (DCA), and physical points on your DNP I/O modules, for each module type and option.

DNP Point Mapping – DNP DC Analog Input Module

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Input 0	+ ANALOG I/P 1	1
	- ANALOG I/P 1	51
	SHIELD 1	2
DNP3 Analog Input 1	+ ANALOG I/P 2	3
	- ANALOG I/P 2	53
	SHIELD 2	52
DNP3 Analog Input 2	+ ANALOG I/P 3	4
	- ANALOG I/P 3	54
	SHIELD 3	5
DNP3 Analog Input 3	+ ANALOG I/P 4	6
	- ANALOG I/P 4	56
	SHIELD 4	55
DNP3 Analog Input 4	+ ANALOG I/P 5	7
	- ANALOG I/P 5	57
	SHIELD 5	8
DNP3 Analog Input 5	+ ANALOG I/P 6	9
	- ANALOG I/P 6	59
	SHIELD 6	58
DNP3 Analog Input 6	+ ANALOG I/P 7	10
	- ANALOG I/P 7	60
	SHIELD 7	11
DNP3 Analog Input 7	+ ANALOG I/P 8	12
	- ANALOG I/P 8	62
	SHIELD 8	61
DNP3 Analog Input 8	+ ANALOG I/P 9	13
	- ANALOG I/P 9	63
	SHIELD 9	14
DNP3 Analog Input 9	+ ANALOG I/P 10	15
	- ANALOG I/P 10	65
	SHIELD 10	64
DNP3 Analog Input 10	+ ANALOG I/P 11	16
	- ANALOG I/P 11	66
	SHIELD 11	17
DNP3 Analog Input 11	+ ANALOG I/P 12	18
	- ANALOG I/P 12	68
	SHIELD 12	67

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Input 12	+ ANALOG I/P 13	19
	- ANALOG I/P 13	69
	SHIELD 13	20
DNP3 Analog Input 13	+ ANALOG I/P 14	21
	- ANALOG I/P 14	71
	SHIELD 14	70
DNP3 Analog Input 14	+ ANALOG I/P 15	22
	- ANALOG I/P 15	72
	SHIELD 15	23
DNP3 Analog Input 15	+ ANALOG I/P 16	24
	- ANALOG I/P 16	74
	SHIELD 16	73
DNP3 Analog Input 16	+ ANALOG I/P 17	25
	- ANALOG I/P 17	75
	SHIELD 17	26
DNP3 Analog Input 17	+ ANALOG I/P 18	27
	- ANALOG I/P 18	77
	SHIELD 18	76
DNP3 Analog Input 18	+ ANALOG I/P 19	28
	- ANALOG I/P 19	78
	SHIELD 19	29
DNP3 Analog Input 19	+ ANALOG I/P 20	30
	- ANALOG I/P 20	80
	SHIELD 20	79
DNP3 Analog Input 20	+ ANALOG I/P 21	31
	- ANALOG I/P 21	81
	SHIELD 21	32
DNP3 Analog Input 21	+ ANALOG I/P 22	33
	- ANALOG I/P 22	83
	SHIELD 22	82
DNP3 Analog Input 22	+ ANALOG I/P 23	34
	- ANALOG I/P 23	84
	SHIELD 23	35
DNP3 Analog Input 23	+ ANALOG I/P 24	36
	- ANALOG I/P 24	86
	SHIELD 24	85

I/P	Input

DNP Point Mapping – DNP DC Analog Input Module, continued

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Input 24	+ ANALOG I/P 25	37
	- ANALOG I/P 25	87
	SHIELD 25	38
DNP3 Analog Input 25	+ ANALOG I/P 26	39
	- ANALOG I/P 26	89
	SHIELD 26	88
DNP3 Analog Input 26	+ ANALOG I/P 27	40
	- ANALOG I/P 27	90
	SHIELD 27	41
DNP3 Analog Input 27	+ ANALOG I/P 28	42
	- ANALOG I/P 28	92
	SHIELD 28	91
DNP3 Analog Input 28	+ ANALOG I/P 29	43
	- ANALOG I/P 29	93
	SHIELD 29	44
DNP3 Analog Input 29	+ ANALOG I/P 30	45
	- ANALOG I/P 30	95
	SHIELD 30	94
DNP3 Analog Input 30	+ ANALOG I/P 31	46
	- ANALOG I/P 31	96
	SHIELD 31	47
DNP3 Analog Input 31	+ ANALOG I/P 32	48
	- ANALOG I/P 32	98
	SHIELD 32	97

DNP Point Mapping – DNP Control Output Module (Trip/Close)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	T1	4
	C1	57
DNP3 Control Point 1	T2	58
	C2	6
DNP3 Control Point 2	T3	7
	C3	60
DNP3 Control Point 3	T4	61
	C4	9
DNP3 Control Point 4	T5	10
	C5	63
DNP3 Control Point 5	T6	64
	C6	12
DNP3 Control Point 6	T7	13
	C7	66
DNP3 Control Point 7	T8	67
	C8	15
DNP3 Control Point 8	T9	16
	C9	69
DNP3 Control Point 9	T10	70
	C10	18
DNP3 Control Point 10	T11	19
	C11	72
DNP3 Control Point 11	T12	73
	C12	21
DNP3 Control Point 12	T13	22
	C13	75
DNP3 Control Point 13	T14	76
	C14	24
DNP3 Control Point 14	T15	25
	C15	78
DNP3 Control Point 15	T16	79
	C16	27
DNP3 Control Point 16	T17	28
	C17	81
DNP3 Control Point 17	T18	82
	C18	30
DNP3 Control Point 18	T19	31
	C19	84

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 19	T20	85
	C20	33
DNP3 Control Point 20	T21	34
	C21	87
DNP3 Control Point 21	T22	88
	C22	36
DNP3 Control Point 22	T23	37
	C23	90
DNP3 Control Point 23	T24	91
	C24	39
DNP3 Control Point 24	T25	40
	C25	93
DNP3 Control Point 25	T26	94
	C26	42
DNP3 Control Point 26	T27	43
	C27	96
DNP3 Control Point 27	T28	97
	C28	45
DNP3 Control Point 28	T29	46
	C29	99
DNP3 Control Point 29	T30	100
	C30	48
DNP3 Control Point 30	T31	49
	C31	102
DNP3 Control Point 31	T32	103
	C32	51

T	Trip
C	Close

DNP Point Mapping – DNP Control Output Module (Raise/Lower)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	R16	4
DNP3 Control Point 1	L16	58
DNP3 Control Point 2	R15	7
DNP3 Control Point 3	L15	61
DNP3 Control Point 4	R14	10
DNP3 Control Point 5	L14	64
DNP3 Control Point 6	R13	13
DNP3 Control Point 7	L13	67
DNP3 Control Point 8	R12	16
DNP3 Control Point 9	L12	70
DNP3 Control Point 10	R11	19
DNP3 Control Point 11	L11	73
DNP3 Control Point 12	R10	22
DNP3 Control Point 13	L10	76
DNP3 Control Point 14	R9	25
DNP3 Control Point 15	L9	79
DNP3 Control Point 16	R8	28
DNP3 Control Point 17	L8	82
DNP3 Control Point 18	R7	31
DNP3 Control Point 19	L7	85
DNP3 Control Point 20	R6	34
DNP3 Control Point 21	L6	88
DNP3 Control Point 22	R5	37
DNP3 Control Point 23	L5	91
DNP3 Control Point 24	R4	40
DNP3 Control Point 25	L4	94
DNP3 Control Point 26	R3	43
DNP3 Control Point 27	L3	97
DNP3 Control Point 28	R2	46
DNP3 Control Point 29	L2	100
DNP3 Control Point 30	R1	49
DNP3 Control Point 31	L1	103

R	Raise
L	Lower

DNP Point Mapping – DNP Control Output Module (Form C)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	NO1	4
	COM1	57
	NC1	5
DNP3 Control Point 1	NO2	58
	COM2	6
	NC2	59
DNP3 Control Point 2	NO3	7
	COM3	60
	NC3	8
DNP3 Control Point 3	NO4	61
	COM4	9
	NC4	62
DNP3 Control Point 4	NO5	10
	COM5	63
	NC5	11
DNP3 Control Point 5	NO6	64
	COM6	12
	NC6	65
DNP3 Control Point 6	NO7	13
	COM7	66
	NC7	14
DNP3 Control Point 7	NO8	67
	COM8	15
	NC8	68
DNP3 Control Point 8	NO9	16
	COM9	69
	NC9	17
DNP3 Control Point 9	NO10	70
	COM10	18
	NC10	71
DNP3 Control Point 10	NO11	19
	COM11	72
	NC11	20
DNP3 Control Point 11	NO12	73
	COM12	21
	NC12	74
DNP3 Control Point 12	NO13	22
	COM13	75
	NC13	23

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point	NO14	76
	COM14	24
	NC14	77
DNP3 Control Point	NO15	25
	COM15	78
	NC15	26
DNP3 Control Point	NO16	79
	COM16	27
	NC16	80
DNP3 Control Point	NO17	28
	COM17	81
	NC17	29
DNP3 Control Point	NO18	82
	COM18	30
	NC18	83
DNP3 Control Point	NO19	31
	COM19	84
	NC19	32
DNP3 Control Point	NO20	85
	COM20	33
	NC20	86
DNP3 Control Point	NO21	34
	COM21	87
	NC21	35
DNP3 Control Point	NO22	88
	COM22	36
	NC22	89
DNP3 Control Point	NO23	37
	COM23	90
	NC23	38
DNP3 Control Point	NO24	91
	COM24	39
	NC24	92
DNP3 Control Point	NO25	40
	COM25	93
	NC25	41
DNP3 Control Point	NO26	94
	COM26	42
	NC26	95

DNP Point Mapping – DNP Control Output Module (Form C), continued

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point	NO27	43
	COM27	96
	NC27	44
DNP3 Control Point	NO28	97
	COM28	45
	NC28	98
DNP3 Control Point	NO29	46
	COM29	99
	NC29	47
DNP3 Control Point	NO30	100
	COM30	48
	NC30	101
DNP3 Control Point	NO31	49
	COM31	102
	NC31	50
DNP3 Control Point	NO32	103
	COM32	51
	NC32	104

NO	Normally Open
NC	Normally Closed

DNP Point Mapping – DNP Digital Input Module (Single Status)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 0	STATUS I/P 1	1
DNP3 Status Input 1	STATUS I/P 2	2
DNP3 Status Input 2	STATUS I/P 3	3
DNP3 Status Input 3	STATUS I/P 4	4
DNP3 Status Input 4	STATUS I/P 5	5
DNP3 Status Input 5	STATUS I/P 6	6
DNP3 Status Input 6	STATUS I/P 7	7
DNP3 Status Input 7	STATUS I/P 8	8
DNP3 Status Input 8	STATUS I/P 9	9
DNP3 Status Input 9	STATUS I/P 10	10
DNP3 Status Input 10	STATUS I/P 11	11
DNP3 Status Input 11	STATUS I/P 12	12
DNP3 Status Input 12	STATUS I/P 13	13
DNP3 Status Input 13	STATUS I/P 14	14
DNP3 Status Input 14	STATUS I/P 15	15
DNP3 Status Input 15	STATUS I/P 16	16
DNP3 Status Input 16	STATUS I/P 17	17
DNP3 Status Input 17	STATUS I/P 18	18
DNP3 Status Input 18	STATUS I/P 19	19
DNP3 Status Input 19	STATUS I/P 20	20
DNP3 Status Input 20	STATUS I/P 21	21
DNP3 Status Input 21	STATUS I/P 22	22
DNP3 Status Input 22	STATUS I/P 23	23
DNP3 Status Input 23	STATUS I/P 24	24
DNP3 Status Input 24	STATUS I/P 25	25
DNP3 Status Input 25	STATUS I/P 26	26
DNP3 Status Input 26	STATUS I/P 27	27
DNP3 Status Input 27	STATUS I/P 28	28
DNP3 Status Input 28	STATUS I/P 29	29
DNP3 Status Input 29	STATUS I/P 30	30
DNP3 Status Input 30	STATUS I/P 31	31
DNP3 Status Input 31	STATUS I/P 32	32
DNP3 Status Input 32	STATUS I/P 33	33
DNP3 Status Input 33	STATUS I/P 34	34
DNP3 Status Input 34	STATUS I/P 35	35
DNP3 Status Input 35	STATUS I/P 36	36
DNP3 Status Input 36	STATUS I/P 37	37
DNP3 Status Input 37	STATUS I/P 38	38
DNP3 Status Input 38	STATUS I/P 39	39

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 39	STATUS I/P 40	40
DNP3 Status Input 40	STATUS I/P 41	41
DNP3 Status Input 41	STATUS I/P 42	42
DNP3 Status Input 42	STATUS I/P 43	43
DNP3 Status Input 43	STATUS I/P 44	44
DNP3 Status Input 44	STATUS I/P 45	45
DNP3 Status Input 45	STATUS I/P 46	46
DNP3 Status Input 46	STATUS I/P 47	47
DNP3 Status Input 47	STATUS I/P 48	48
DNP3 Status Input 48	STATUS I/P 49	49
DNP3 Status Input 49	STATUS I/P 50	50
DNP3 Status Input 50	STATUS I/P 51	51
DNP3 Status Input 51	STATUS I/P 52	52
DNP3 Status Input 52	STATUS I/P 53	53
DNP3 Status Input 53	STATUS I/P 54	54
DNP3 Status Input 54	STATUS I/P 55	55
DNP3 Status Input 55	STATUS I/P 56	56
DNP3 Status Input 56	STATUS I/P 57	57
DNP3 Status Input 57	STATUS I/P 58	58
DNP3 Status Input 58	STATUS I/P 59	59
DNP3 Status Input 59	STATUS I/P 60	60
DNP3 Status Input 60	STATUS I/P 61	61
DNP3 Status Input 61	STATUS I/P 62	62
DNP3 Status Input 62	STATUS I/P 63	63
DNP3 Status Input 63	STATUS I/P 64	64

DNP Point Mapping – Digital Input Module (Double Status)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 0	STATUS I/P 1	1
	STATUS I/P 2	2
DNP3 Status Input 1	STATUS I/P 3	3
	STATUS I/P 4	4
DNP3 Status Input 2	STATUS I/P 5	5
	STATUS I/P 6	6
DNP3 Status Input 3	STATUS I/P 7	7
	STATUS I/P 8	8
DNP3 Status Input 4	STATUS I/P 9	9
	STATUS I/P 10	10
DNP3 Status Input 5	STATUS I/P 11	11
	STATUS I/P 12	12
DNP3 Status Input 6	STATUS I/P 13	13
	STATUS I/P 14	14
DNP3 Status Input 7	STATUS I/P 15	15
	STATUS I/P 16	16
DNP3 Status Input 8	STATUS I/P 17	17
	STATUS I/P 18	18
DNP3 Status Input 9	STATUS I/P 19	19
	STATUS I/P 20	20
DNP3 Status Input 10	STATUS I/P 21	21
	STATUS I/P 22	22
DNP3 Status Input 11	STATUS I/P 23	23
	STATUS I/P 24	24
DNP3 Status Input 12	STATUS I/P 25	25
	STATUS I/P 26	26
DNP3 Status Input 13	STATUS I/P 27	27
	STATUS I/P 28	28
DNP3 Status Input 14	STATUS I/P 29	29
	STATUS I/P 30	30
DNP3 Status Input 15	STATUS I/P 31	31
	STATUS I/P 32	32
DNP3 Status Input 16	STATUS I/P 33	33
	STATUS I/P 34	34

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 17	STATUS I/P 35	35
	STATUS I/P 36	36
DNP3 Status Input 18	STATUS I/P 37	37
	STATUS I/P 38	38
DNP3 Status Input 19	STATUS I/P 39	39
	STATUS I/P 40	40
DNP3 Status Input 20	STATUS I/P 41	41
	STATUS I/P 42	42
DNP3 Status Input 21	STATUS I/P 43	43
	STATUS I/P 44	44
DNP3 Status Input 22	STATUS I/P 45	45
	STATUS I/P 46	46
DNP3 Status Input 23	STATUS I/P 47	47
	STATUS I/P 48	48
DNP3 Status Input 24	STATUS I/P 49	49
	STATUS I/P 50	50
DNP3 Status Input 25	STATUS I/P 51	51
	STATUS I/P 52	52
DNP3 Status Input 26	STATUS I/P 53	53
	STATUS I/P 54	54
DNP3 Status Input 27	STATUS I/P 55	55
	STATUS I/P 56	56
DNP3 Status Input 28	STATUS I/P 57	57
	STATUS I/P 58	58
DNP3 Status Input 29	STATUS I/P 59	59
	STATUS I/P 60	60
DNP3 Status Input 30	STATUS I/P 61	61
	STATUS I/P 62	62
DNP3 Status Input 31	STATUS I/P 63	63
	STATUS I/P 64	64

DNP Point Mapping – Digital Input Module (Single Counter)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 0	STATUS I/P 1	1
DNP3 Counter Input 1	STATUS I/P 2	2
DNP3 Counter Input 2	STATUS I/P 3	3
DNP3 Counter Input 3	STATUS I/P 4	4
DNP3 Counter Input 4	STATUS I/P 5	5
DNP3 Counter Input 5	STATUS I/P 6	6
DNP3 Counter Input 6	STATUS I/P 7	7
DNP3 Counter Input 7	STATUS I/P 8	8
DNP3 Counter Input 8	STATUS I/P 9	9
DNP3 Counter Input 9	STATUS I/P 10	10
DNP3 Counter Input 10	STATUS I/P 11	11
DNP3 Counter Input 11	STATUS I/P 12	12
DNP3 Counter Input 12	STATUS I/P 13	13
DNP3 Counter Input 13	STATUS I/P 14	14
DNP3 Counter Input 14	STATUS I/P 15	15
DNP3 Counter Input 15	STATUS I/P 16	16
DNP3 Counter Input 16	STATUS I/P 17	17
DNP3 Counter Input 17	STATUS I/P 18	18
DNP3 Counter Input 18	STATUS I/P 19	19
DNP3 Counter Input 19	STATUS I/P 20	20
DNP3 Counter Input 20	STATUS I/P 21	21
DNP3 Counter Input 21	STATUS I/P 22	22
DNP3 Counter Input 22	STATUS I/P 23	23
DNP3 Counter Input 23	STATUS I/P 24	24
DNP3 Counter Input 24	STATUS I/P 25	25
DNP3 Counter Input 25	STATUS I/P 26	26
DNP3 Counter Input 26	STATUS I/P 27	27
DNP3 Counter Input 27	STATUS I/P 28	28
DNP3 Counter Input 28	STATUS I/P 29	29
DNP3 Counter Input 29	STATUS I/P 30	30
DNP3 Counter Input 30	STATUS I/P 31	31
DNP3 Counter Input 31	STATUS I/P 32	32
DNP3 Counter Input 32	STATUS I/P 33	33
DNP3 Counter Input 33	STATUS I/P 34	34
DNP3 Counter Input 34	STATUS I/P 35	35
DNP3 Counter Input 35	STATUS I/P 36	36
DNP3 Counter Input 36	STATUS I/P 37	37
DNP3 Counter Input 37	STATUS I/P 38	38

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 38	STATUS I/P 39	39
DNP3 Counter Input 39	STATUS I/P 40	40
DNP3 Counter Input 40	STATUS I/P 41	41
DNP3 Counter Input 41	STATUS I/P 42	42
DNP3 Counter Input 42	STATUS I/P 43	43
DNP3 Counter Input 43	STATUS I/P 44	44
DNP3 Counter Input 44	STATUS I/P 45	45
DNP3 Counter Input 45	STATUS I/P 46	46
DNP3 Counter Input 46	STATUS I/P 47	47
DNP3 Counter Input 47	STATUS I/P 48	48
DNP3 Counter Input 48	STATUS I/P 49	49
DNP3 Counter Input 49	STATUS I/P 50	50
DNP3 Counter Input 50	STATUS I/P 51	51
DNP3 Counter Input 51	STATUS I/P 52	52
DNP3 Counter Input 52	STATUS I/P 53	53
DNP3 Counter Input 53	STATUS I/P 54	54
DNP3 Counter Input 54	STATUS I/P 55	55
DNP3 Counter Input 55	STATUS I/P 56	56
DNP3 Counter Input 56	STATUS I/P 57	57
DNP3 Counter Input 57	STATUS I/P 58	58
DNP3 Counter Input 58	STATUS I/P 59	59
DNP3 Counter Input 59	STATUS I/P 60	60
DNP3 Counter Input 60	STATUS I/P 61	61
DNP3 Counter Input 61	STATUS I/P 62	62
DNP3 Counter Input 62	STATUS I/P 63	63
DNP3 Counter Input 63	STATUS I/P 64	64

DNP Point Mapping – Digital Input Module (Double Counter)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 0	STATUS I/P 1	1
	STATUS I/P 2	2
DNP3 Counter Input 1	STATUS I/P 3	3
	STATUS I/P 4	4
DNP3 Counter Input 2	STATUS I/P 5	5
	STATUS I/P 6	6
DNP3 Counter Input 3	STATUS I/P 7	7
	STATUS I/P 8	8
DNP3 Counter Input 4	STATUS I/P 9	9
	STATUS I/P 10	10
DNP3 Counter Input 5	STATUS I/P 11	11
	STATUS I/P 12	12
DNP3 Counter Input 6	STATUS I/P 13	13
	STATUS I/P 14	14
DNP3 Counter Input 7	STATUS I/P 15	15
	STATUS I/P 16	16
DNP3 Counter Input 8	STATUS I/P 17	17
	STATUS I/P 18	18
DNP3 Counter Input 9	STATUS I/P 19	19
	STATUS I/P 20	20
DNP3 Counter Input 10	STATUS I/P 21	21
	STATUS I/P 22	22
DNP3 Counter Input 11	STATUS I/P 23	23
	STATUS I/P 24	24
DNP3 Counter Input 12	STATUS I/P 25	25
	STATUS I/P 26	26
DNP3 Counter Input 13	STATUS I/P 27	27
	STATUS I/P 28	28
DNP3 Counter Input 14	STATUS I/P 29	29
	STATUS I/P 30	30
DNP3 Counter Input 15	STATUS I/P 31	31
	STATUS I/P 32	32
DNP3 Counter Input 16	STATUS I/P 33	33
	STATUS I/P 34	34
DNP3 Counter Input 17	STATUS I/P 35	35
	STATUS I/P 36	36
DNP3 Counter Input 18	STATUS I/P 37	37
	STATUS I/P 38	38

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 19	STATUS I/P 39	39
	STATUS I/P 40	40
DNP3 Counter Input 20	STATUS I/P 41	41
	STATUS I/P 42	42
DNP3 Counter Input 21	STATUS I/P 43	43
	STATUS I/P 44	44
DNP3 Counter Input 22	STATUS I/P 45	45
	STATUS I/P 46	46
DNP3 Counter Input 23	STATUS I/P 47	47
	STATUS I/P 48	48
DNP3 Counter Input 24	STATUS I/P 49	49
	STATUS I/P 50	50
DNP3 Counter Input 25	STATUS I/P 51	51
	STATUS I/P 52	52
DNP3 Counter Input 26	STATUS I/P 53	53
	STATUS I/P 54	54
DNP3 Counter Input 27	STATUS I/P 55	55
	STATUS I/P 56	56
DNP3 Counter Input 28	STATUS I/P 57	57
	STATUS I/P 58	58
DNP3 Counter Input 29	STATUS I/P 59	59
	STATUS I/P 60	60
DNP3 Counter Input 30	STATUS I/P 61	61
	STATUS I/P 62	62
DNP3 Counter Input 31	STATUS I/P 63	63
	STATUS I/P 64	64

DNP Point Mapping – DNP Combination Module (Digital Input - Single Status)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 0	STATUS I/P 1	35
DNP3 Status Input 1	STATUS I/P 2	36
DNP3 Status Input 2	STATUS I/P 3	37
DNP3 Status Input 3	STATUS I/P 4	38
DNP3 Status Input 4	STATUS I/P 5	39
DNP3 Status Input 5	STATUS I/P 6	40
DNP3 Status Input 6	STATUS I/P 7	41
DNP3 Status Input 7	STATUS I/P 8	42
DNP3 Status Input 8	STATUS I/P 9	43
DNP3 Status Input 9	STATUS I/P 10	44
DNP3 Status Input 10	STATUS I/P 11	45
DNP3 Status Input 11	STATUS I/P 12	46
DNP3 Status Input 12	STATUS I/P 13	47
DNP3 Status Input 13	STATUS I/P 14	48
DNP3 Status Input 14	STATUS I/P 15	49
DNP3 Status Input 15	STATUS I/P 16	50

DNP Point Mapping – DNP Combination Module (Digital Input - Double Status)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Status Input 0	STATUS I/P 1	35
	STATUS I/P 2	36
DNP3 Status Input 1	STATUS I/P 3	37
	STATUS I/P 4	38
DNP3 Status Input 2	STATUS I/P 5	39
	STATUS I/P 6	40
DNP3 Status Input 3	STATUS I/P 7	41
	STATUS I/P 8	42
DNP3 Status Input 4	STATUS I/P 9	43
	STATUS I/P 10	44
DNP3 Status Input 5	STATUS I/P 11	45
	STATUS I/P 12	46
DNP3 Status Input 6	STATUS I/P 13	47
	STATUS I/P 14	48
DNP3 Status Input 7	STATUS I/P 15	49
	STATUS I/P 16	50

DNP Point Mapping – DNP Combination Module (Digital Input - Single Counter)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 0	STATUS I/P 1	35
DNP3 Counter Input 1	STATUS I/P 2	36
DNP3 Counter Input 2	STATUS I/P 3	37
DNP3 Counter Input 3	STATUS I/P 4	38
DNP3 Counter Input 4	STATUS I/P 5	39
DNP3 Counter Input 5	STATUS I/P 6	40
DNP3 Counter Input 6	STATUS I/P 7	41
DNP3 Counter Input 7	STATUS I/P 8	42
DNP3 Counter Input 8	STATUS I/P 9	43
DNP3 Counter Input 9	STATUS I/P 10	44
DNP3 Counter Input 10	STATUS I/P 11	45
DNP3 Counter Input 11	STATUS I/P 12	46
DNP3 Counter Input 12	STATUS I/P 13	47
DNP3 Counter Input 13	STATUS I/P 14	48
DNP3 Counter Input 14	STATUS I/P 15	49
DNP3 Counter Input 15	STATUS I/P 16	50

DNP Point Mapping – DNP Combination Module (Digital Input - Double Counter)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Counter Input 0	STATUS I/P 1	35
	STATUS I/P 2	36
DNP3 Counter Input 1	STATUS I/P 3	37
	STATUS I/P 4	38
DNP3 Counter Input 2	STATUS I/P 5	39
	STATUS I/P 6	40
DNP3 Counter Input 3	STATUS I/P 7	41
	STATUS I/P 8	42
DNP3 Counter Input 4	STATUS I/P 9	43
	STATUS I/P 10	44
DNP3 Counter Input 5	STATUS I/P 11	45
	STATUS I/P 12	46
DNP3 Counter Input 6	STATUS I/P 13	47
	STATUS I/P 14	48
DNP3 Counter Input 7	STATUS I/P 15	49
	STATUS I/P 16	50

DNP Point Mapping – DNP Combination Module (Digital Output - Trip/Close)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	T1	52
	C1	3
DNP3 Control Point 1	T2	4
	C2	54
DNP3 Control Point 2	T3	55
	C3	6
DNP3 Control Point 3	T4	7
	C4	57
DNP3 Control Point 4	T5	58
	C5	9
DNP3 Control Point 5	T6	10
	C6	60
DNP3 Control Point 6	T7	61
	C7	12
DNP3 Control Point 7	T8	13
	C8	63

T	Trip
C	Close

DNP Point Mapping – DNP Combination Module (Digital Output - Raise/Lower)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	R4	52
DNP3 Control Point 1	L4	4
DNP3 Control Point 2	R3	55
DNP3 Control Point 3	L3	7
DNP3 Control Point 4	R2	58
DNP3 Control Point 5	L2	10
DNP3 Control Point 6	R1	61
DNP3 Control Point 7	L1	13

R	Raise
L	Lower

DNP Point Mapping – DNP Combination Module (Digital Output - Form C)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Control Point 0	NO1	52
	COM1	3
	NC1	53
DNP3 Control Point 1	NO2	4
	COM2	54
	NC2	5
DNP3 Control Point 2	NO3	55
	COM3	6
	NC3	56
DNP3 Control Point 3	NO4	7
	COM4	57
	NC4	8
DNP3 Control Point 4	NO5	58
	COM5	9
	NC5	59
DNP3 Control Point 5	NO6	10
	COM6	60
	NC6	11
DNP3 Control Point 6	NO7	61
	COM7	12
	NC7	62
DNP3 Control Point 7	NO8	13
	COM8	63
	NC8	14

NO	Normally Open
NC	Normally Closed

DNP Point Mapping – DNP Combination Module (Analog Input)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Input 0	+ ANALOG I/P 1	64
	- ANALOG I/P 1	15
	SHIELD 1	65
DNP3 Analog Input 1	+ ANALOG I/P 2	16
	- ANALOG I/P 2	66
	SHIELD 2	65
DNP3 Analog Input 2	+ ANALOG I/P 3	17
	- ANALOG I/P 3	67
	SHIELD 3	18
DNP3 Analog Input 3	+ ANALOG I/P 4	68
	- ANALOG I/P 4	19
	SHIELD 4	18
DNP3 Analog Input 4	+ ANALOG I/P 5	69
	- ANALOG I/P 5	20
	SHIELD 5	70
DNP3 Analog Input 5	+ ANALOG I/P 6	21
	- ANALOG I/P 6	71
	SHIELD 6	70
DNP3 Analog Input 6	+ ANALOG I/P 7	22
	- ANALOG I/P 7	72
	SHIELD 7	23
DNP3 Analog Input 7	+ ANALOG I/P 8	73
	- ANALOG I/P 8	24
	SHIELD 8	23
DNP3 Analog Input 8	+ ANALOG I/P 9	74
	- ANALOG I/P 9	25
	SHIELD 9	75
DNP3 Analog Input 9	+ ANALOG I/P 10	26
	- ANALOG I/P 10	76
	SHIELD 10	75
DNP3 Analog Input 10	+ ANALOG I/P 11	27
	- ANALOG I/P 11	77
	SHIELD 11	28
DNP3 Analog Input 11	+ ANALOG I/P 12	78
	- ANALOG I/P 12	29
	SHIELD 12	28

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Input 12	+ ANALOG I/P 13	79
	- ANALOG I/P 13	30
	SHIELD 13	80
DNP3 Analog Input 13	+ ANALOG I/P 14	31
	- ANALOG I/P 14	81
	SHIELD 14	80
DNP3 Analog Input 14	+ ANALOG I/P 15	32
	- ANALOG I/P 15	82
	SHIELD 15	33
DNP3 Analog Input 15	+ ANALOG I/P 16	34
	- ANALOG I/P 16	83
	SHIELD 16	33

I/P	Input

DNP Point Mapping – DNP Combination Module (Analog Output)

	DNP I/O Module Connection	
DNP3 Point	**Description**	**TB1**
DNP3 Analog Output 0	+ ANALOG O/P 1	74
	- ANALOG O/P 1	25
	SHIELD 1	75
DNP3 Analog Output 1	+ ANALOG O/P 2	26
	- ANALOG O/P 2	76
	SHIELD 2	75
DNP3 Analog Output 2	+ ANALOG O/P 3	27
	- ANALOG O/P 3	77
	SHIELD 3	28
DNP3 Analog Output 3	+ ANALOG O/P 4	78
	- ANALOG O/P 4	29
	SHIELD 4	28
DNP3 Analog Output 4	+ ANALOG O/P 5	79
	- ANALOG O/P 5	30
	SHIELD 5	80
DNP3 Analog Output 5	+ ANALOG O/P 6	31
	- ANALOG O/P 6	81
	SHIELD 6	80
DNP3 Analog Output 6	+ ANALOG O/P 7	32
	- ANALOG O/P 7	82
	SHIELD 7	33
DNP3 Analog Output 7	+ ANALOG O/P 8	34
	- ANALOG O/P 8	83
	SHIELD 8	33

O/P	Output

Appendix C: DNP I/O Modules DB9 Connector Pinouts

The following table gives DB9 Connector pinouts for J1/J2 DNP3 Link communication ports on the WESTERM boards:

Pin Number	Function	Signal Direction	
		INPUT	OUTPUT
1	GND		
2	NOT USED		
3	NOT USED		
4	+ DC1	√	
5	- DC1	√	
6	TX/RX2	√	√
7	$\overline{\text{TX/RX2}}$	√	√
8	NOT USED		
9	NOT USED		

Appendix D: DNP Address Jumpers

The following table shows the jumper settings for programming the DNP address on DNP I/O Modules. Refer to “Configuring your DNP I/O Module” on page 19 for further information.

		Z1 Jumper Settings					
DNP Address		**1-16**	**2-15**	**3-14**	**4-13**	**5-12**	**6-11**
0	000000	OUT	OUT	OUT	OUT	OUT	OUT
1	000001	IN	OUT	OUT	OUT	OUT	OUT
2	000010	OUT	IN	OUT	OUT	OUT	OUT
3	000011	IN	IN	OUT	OUT	OUT	OUT
4	000100	OUT	OUT	IN	OUT	OUT	OUT
5	000101	IN	OUT	IN	OUT	OUT	OUT
6	000110	OUT	IN	IN	OUT	OUT	OUT
7	000111	IN	IN	IN	OUT	OUT	OUT
8	001000	OUT	OUT	OUT	IN	OUT	OUT
9	001001	IN	OUT	OUT	IN	OUT	OUT
10	001010	OUT	IN	OUT	IN	OUT	OUT
11	001011	IN	IN	OUT	IN	OUT	OUT
12	001100	OUT	OUT	IN	IN	OUT	OUT
13	001101	IN	OUT	IN	IN	OUT	OUT
14	001110	OUT	IN	IN	IN	OUT	OUT
15	001111	IN	IN	IN	IN	OUT	OUT
16	010000	OUT	OUT	OUT	OUT	IN	OUT
17	010001	IN	OUT	OUT	OUT	IN	OUT
18	010010	OUT	IN	OUT	OUT	IN	OUT
19	010011	IN	IN	OUT	OUT	IN	OUT
20	010100	OUT	OUT	IN	OUT	IN	OUT
21	010101	IN	OUT	IN	OUT	IN	OUT
22	010110	OUT	IN	IN	OUT	IN	OUT
23	010111	IN	IN	IN	OUT	IN	OUT
24	011000	OUT	OUT	OUT	IN	IN	OUT
25	011001	IN	OUT	OUT	IN	IN	OUT
26	011010	OUT	IN	OUT	IN	IN	OUT
27	011011	IN	IN	OUT	IN	IN	OUT
28	011100	OUT	OUT	IN	IN	IN	OUT
29	011101	IN	OUT	IN	IN	IN	OUT
30	011110	OUT	IN	IN	IN	IN	OUT
31	011111	IN	IN	IN	IN	IN	OUT

		Z1 Jumper Settings					
DNP Address		**1-16**	**2-15**	**3-14**	**4-13**	**5-12**	**6-11**
32	100000	OUT	OUT	OUT	OUT	OUT	IN
33	100001	IN	OUT	OUT	OUT	OUT	IN
34	100010	OUT	IN	OUT	OUT	OUT	IN
35	100011	IN	IN	OUT	OUT	OUT	IN
36	100100	OUT	OUT	IN	OUT	OUT	IN
37	100101	IN	OUT	IN	OUT	OUT	IN
38	100110	OUT	IN	IN	OUT	OUT	IN
39	100111	IN	IN	IN	OUT	OUT	IN
40	101000	OUT	OUT	OUT	IN	OUT	IN
41	101001	IN	OUT	OUT	IN	OUT	IN
42	101010	OUT	IN	OUT	IN	OUT	IN
43	101011	IN	IN	OUT	IN	OUT	IN
44	101100	OUT	OUT	IN	IN	OUT	IN
45	101101	IN	OUT	IN	IN	OUT	IN
46	101110	OUT	IN	IN	IN	OUT	IN
47	101111	IN	IN	IN	IN	OUT	IN
48	110000	OUT	OUT	OUT	OUT	IN	IN
49	110001	IN	OUT	OUT	OUT	IN	IN
50	110010	OUT	IN	OUT	OUT	IN	IN
51	110011	IN	IN	OUT	OUT	IN	IN
52	110100	OUT	OUT	IN	OUT	IN	IN
53	110101	IN	OUT	IN	OUT	IN	IN
54	110110	OUT	IN	IN	OUT	IN	IN
55	110111	IN	IN	IN	OUT	IN	IN
56	111000	OUT	OUT	OUT	IN	IN	IN
57	111001	IN	OUT	OUT	IN	IN	IN
58	111010	OUT	IN	OUT	IN	IN	IN
59	111011	IN	IN	OUT	IN	IN	IN
60	111100	OUT	OUT	IN	IN	IN	IN
61	111101	IN	OUT	IN	IN	IN	IN
62	111110	OUT	IN	IN	IN	IN	IN
63	111111	IN	IN	IN	IN	IN	IN

Appendix E: DNP I/O Modules Device Profile

The information presented in this appendix summarizes the DNP3 implementation of the DNP I/O Modules (Digital Input Module, DC Analog Input Module, and Control Output Module). This information is presented in the standard DNP User's Group Device Profile Document format.

Notes:

1. The DNP I/O Modules will never request Data Link Confirmations from the Master. The DNP I/O Modules, however, will acknowledge Data Link Confirmation requests from a Master. The DNP I/O Modules are designed to operate as local I/O devices on a highly reliable communication media.
2. Data Link retries are not supported.
3. Unsolicited Response messages are not supported.
4. DNP3 Data Link Frame size is defaulted to 292 bytes for both transmit and receive messages.
5. DNP3 Application Fragment size is defaulted to 2048 bytes for both transmit and receive messages.
6. The DNP I/O Modules will not implement any configurable parameters other than the Application Confirmation Timeout period.
7. The DNP I/O Modules will accept request from any Master and will respond to the same.
8. The DNP3 address of the I/O Module is configurable via hardware jumpers. There are a total of 8-bits of jumpers and the DNP3 address makes use the lower 6-bits, while the higher 2-bits are used for Baud Rate selection.
9. The DNP Digital Input Module is defaulted to report binary input changes as Sequence of Events (SOE) using the *Binary Input Change with RelativeTime* object. The SOE are defaulted as Class 1 Data. Static binary input objects are reported using the Status Single Bit (without flag).
10. The DNP DC Analog Input Module is defaulted to report 16-bit analog change event without time object. The analog event changes are defaulted as Class 2 Data. Analog events are not buffered and the analog event value is evaluated at the time when the analog input has exceeded its threshold.
11. The DNP Digital Input Module can be optionally configured the inputs as counters and the counter I/O Module is defaulted to report binary counter change without time. The counter events are defaulted as Class 3 Data.
12. The quality changes for input points of the DNP DC Analog Input Module, and the DNP Digital Input Module shall not generate events to be reported.

DNP3 DEVICE PROFILE DOCUMENT

This document must be accompanied by a table having the following headings:

Object Group	Request Function Codes	Response Function Codes
Object Variation	Request Qualifiers	Response Qualifiers
Object Name (optional)		

Vendor Name:	**GE Energy**
Device Name:	**DNP3 I/O Module – D20A, D20S,D20K and D20C**

Highest DNP Level Supported:	Device Function:
For Requests **Level 2**	□ Master ■ Slave
For Responses **Level 2**	

Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):

- Supports READs of Variation 0 of many objects, and READs of some specific variations.
- Supports "start and stop" qualifiers for reading Analog Input objects.
- Binary Output Status objects (Obj10 Var2) will be reported in a Class 0 data poll.
- Frozen Counter object is not supported. Supports Freeze and Clear function codes 9 and 10 for clearing of Binary Counters stored in NVRAM using Object 20 Variation 0 and Qualifier 6.
- Delay measurement response will always be fixed at 300ms.

Notable objects, functions, and/or qualifiers **NOT** supported for this DNP3 subset level.

- Function Codes 7, 8, 11 and 12 for Binary Counter – All Variations (Object 20, Variation 0)
- Function Codes 1, 7 and 8 for Frozen Counter – All Variations (Object 21, Variation 0)
- Function Code 1 for Analog Output Status – All Variations (Object 40, Variation 0)
- Function Codes 3, 4, 5 and 6 for 16-bit Analog Output Block (Object 41, Variation 2)

Data Link Frame Size (octets):	Maximum Application Fragment Size (octets):
Transmitted **292** (Not Configurable)	Transmitted **2048** (Not Configurable)
Received **292** (Not Configurable)	Received **2048** (Not Configurable)

Maximum Data Link Re-tries:	Maximum Application Layer Re-tries:
■ None	■ None
□ Fixed at _____	□ Configurable
□ Configurable	

Requires Data Link Layer Confirmation:

■ Never

□ Always

□ Sometimes If 'Sometimes', when? _____

□ Configurable If 'Configurable', how? _____

Requires Application Layer Confirmation:

□ Never

□ Always (not recommended)

■ When reporting Event Data (Slave devices only)

□ When sending multi-fragment responses (Slave devices only)

□ Sometimes If 'Sometimes', when? _____

□ Configurable If 'Configurable', how? _____

Timeouts while waiting for:

Data Link Confirm	■ None	□ Fixed at _____	□ Variable	□ Configurable
Complete Appl. Fragment	■ None	□ Fixed at _____	□ Variable	□ Configurable
Application Confirm	□ None	■ Fixed at **(2 seconds)**	□ Variable	□ Configurable
Complete Appl. Response	■ None	□ Fixed at _____	□ Variable	□ Configurable

Others _____

Attach explanation if 'Variable' or 'Configurable' was checked for any timeout

Sends/Executes Control Operations:

WRITE Binary Outputs	■ Never	□ Always	□ Sometimes	□ Configurable
SELECT/OPERATE	□ Never	■ Always	□ Sometimes	□ Configurable
DIRECT OPERATE	□ Never	■ Always	□ Sometimes	□ Configurable
DIRECT OPERATE – NO ACK	□ Never	■ Always	□ Sometimes	□ Configurable
Count > 1	□ Never	■ Always	□ Sometimes	□ Configurable
Pulse On	□ Never	■ Always	□ Sometimes	□ Configurable
Pulse Off	□ Never	■ Always	□ Sometimes	□ Configurable
Latch On	□ Never	□ Always	■ Sometimes	□ Configurable
Latch Off	□ Never	□ Always	■ Sometimes	□ Configurable
Queue	■ Never	□ Always	□ Sometimes	□ Configurable
Clear Queue	■ Never	□ Always	□ Sometimes	□ Configurable

Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation.

FILL OUT THE FOLLOWING ITEM FOR MASTER DEVICES ONLY: (Not Applicable)	
Expects Binary Input Change Events: □ Either time-tagged or non-time-tagged for a single event □ Both time-tagged and non-time-tagged for a single event □ Configurable (attach explanation)	
FILL OUT THE FOLLOWING ITEMS FOR SLAVE DEVICES ONLY:	
Reports Binary Input Change Events when no specific variation requested: □ Never ■ Only time-tagged □ Only non-time-tagged □ Configurable to send both, one or the other (attach explanation)	Reports time-tagged Binary Input Change Events when no specific variation requested: □ Never □ Binary Input Change With Time ■ Binary Input Change With Relative Time □ Configurable (attach explanation)
Sends Unsolicited Responses: ■ Never □ Configurable (attach explanation) □ Only certain objects □ Sometimes (attach explanation) □ ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ■ Never □ When Device Restarts □ When Status Flags Change No other options are permitted.
Default Counter Object/Variation: □ No Counters Reported □ Configurable (attach explanation) ■ Default Object **20**_____ Default Variation **5**_____ □ Point-by-point list attached	Counters Roll Over at: □ No Counters Reported □ Configurable (attach explanation) □ 16 Bits ■ 32 Bits (stored in NVRAM) □ Other Value _____ □ Point-by-point list attached
Sends Multi-Fragment Responses: □ Yes ■ No	

Table 1 Objects/Variations/Qualifiers/Function Codes supported by the DNP I/O Modules (DNP Digital Input Module, DNP DC Analog Input Module, DNP Control Output Module and DNP Combination I/O Module)

Obj	Var	Description	Request Function Code	Request Qualifier Codes (Hex)	Response Function Code	Response Qualifier Codes (Hex)	Subset Level /Notes	Supported by DNP3 Peripheral
1	0	Binary Input – ALL Variations	1	06	Not Used	Not Used	2	D20S, D20C
1	1	Single-Bit Binary Input	1	06, 00, 01	129	00	1	D20S, D20C
2	0	Binary Input Change – ALL Variations	1	06	Not Used	Not Used	2	D20S, D20C
2	1	Binary Input Change without Time	1	06, 07, 08	129	17	2	D20S, D20C
2	2	Binary Input Change with Time	1	06, 07, 08	129	17	2	D20S, D20C
2	3	Binary Input Change with Relative Time	1	06, 07, 08	129	17	2	D20S, D20C
10	0	Binary Output – ALL Variations	1	06	Not Used	Not Used	1	D20K, D20C
10	2	Binary Output Status with Flag	1	06, 00, 01	129	00	1	D20K, D20C
12	1	Control Relay Output Block	3, 4, 5, 6	17, 28 quantity = 1	129	Echo of the request	1	D20K, D20C
20	0	Binary Counter – ALL Variations	1	06	Not Used	Not Used	2	D20S, D20C
20	5	32-Bit Binary Counter Without Flag	1	06, 00, 01	129	00	1	D20S, D20C
22	0	Binary Counter Change – ALL Variations	1	06, 07, 08	Not Used	Not Used	2	D20S, D20C
22	1	Binary Counter Change Without Time	1	06, 07, 08	129	17	1	D20S, D20C
30	0	Analog Input – ALL Variations	1	06	Not Used	Not Used	2	D20A, D20C
30	4	16-Bit Analog Input Without Flag	1	06, 00, 01	129	00	2	D20A, D20C
32	0	Analog Change Event – ALL Variations	1	06, 07, 08	Not Used	Not Used	2	D20A, D20C

Obj	Var	Description	Request Function Code	Request Qualifier Codes (Hex)	Response Function Code	Response Qualifier Codes (Hex)	Subset Level /Notes	Supported by DNP3 Peripheral
32	2	16-Bit Analog Change Event Without Time	1	06, 07, 08	129	17	1	D20A, D20C
40	0	Analog Output Status – ALL Variations	1	06	Not Used	Not Used	2	D20C
40	2	16-Bit Analog Output Statue	1	06, 00, 01	129	01	2	D20C
41	0	Analog Output Block – ALL Variations	Not Used	Not Used	Not Used	Not Used	2	D20C
41	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28 quantity=1	129	Echo of the request	1	D20C
50	1	Time and Date	1, 2	07 quantity = 1	129	07 quantity=1	1	ALL
51	1	Time and Date CTO	Not Used	Not Used	129	07 quantity = 1	1	ALL
52	2	Time Delay Fine	Not Used	Not Used	129	07 quantity = 1	1	ALL
60	1	Class 0 Data	1	06	Not Used	Not Used	1	ALL
60	2	Class 1 Data	1	06, 07, 08	Not Used	Not Used	1	ALL
60	3	Class 2 Data	1	06, 07, 08	Not Used	Not Used	1	ALL
60	4	Class 3 Data	1	06, 07, 08	Not Used	Not Used	1	ALL
80	1	Internal Indication	2	00 index = 7	129	Not Used	1	ALL
No Object Specified (Delay Measurement)			23	Not Used	Not Used	Not Used	1	ALL

MODIFICATION RECORD

Version	Revision	Date	Author	Change Description
1.00	0	2005.01.18	CJ	Document created and reviewed.
	1			Release
	2	2005.04.25	MH	Changes as per Tom Wong: pp 14, 35, 36, 37, 53
	3	2005.05.05	MH	Changed reference to 977-0501 on pg. 20 to 977-0502 as per Alex Poda
	4	Jan. 25, 2006	T Wong	Modified cable 944-0502 to remove GND and terminator resistor (page 20)
2.00	0	25.Jul.2007	S. Poda	Add sections related to DNP3 C
		06.Jun.2008	H. Kozlow	Add safety warning as required by SAFER action, minor corrections to DNP3C sections
	1	17.Sep.2008	H. Kozlow	Revised power supply diagram on p. 26
	2	24.Jul.2009	Y. Gomez	Added a note advising that the unit's jumper settings are factory defaulted to trip/close operation.
	3	04.Jan.2012	R. Rees	Replaced PROMAINT cable part number 977-0048 with 977-0300.
	4	19-Oct-2013	R. Rees	Added Connection Labels. Added Troubleshooting - Comms Ground warning.
	5	4-Nov-2013	R. Rees	Added Time Sync note to RTU Master section.

AUTHENTICATION RECORD

Version	Revision	Date	Author	Change Description
2.00	0	15.Sep.2008	H. Kozlow	Modifications related to DNP3C introduction and updates related to D400
	1	17.Sep.2008	H. Kozlow	Revised power supply diagram on p. 26
	2	30.Jul.2009	Y. Gomez	Trip/close jumper note on p. 12.